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Chapter 1 Introduction

1.1 General Information

This instruction book is a guide for configuring the Advant® Smart Device (HART®) Interface which allows you to connect smart devices to an Advant Controller. Information on planning, organizing, and entering data base parameters from the Structure Builder are explained in detail. Also described are other data base configuration entries necessary to provide support for the interface.

This book is not intended to be the sole source of instruction for Advant Smart Device (HART) Interface software. Those people involved in system engineering should attend the applicable system engineering courses offered by ABB.

1.2 Equipment Requirements

The Advant Smart Device (HART) Interface is part of the Advant Controller 410 or Advant Controller 460 subsystem and is used to view and manipulate variables from attached smart devices.

An Advant Controller 410 can be equipped with one or two MultiVendor Interface (MVI) modules which have two RS-232 serial ports each, for a total of 4 ports. Communication is provided by connections between these modules and the SHIMs (Small HART Interface Module) that connect to smart devices.

An Advant Controller 460 can have 3 CPUs with each CPU having one to four MVI modules with two RS-232 serial ports each, for a total of 8 ports. Communication is provided by connections between these modules and the SHIMs that connect to smart devices.

Chapter 2, Installation, of this manual provides information about the types of connections needed between the smart devices and the system.

1.3 How to Use This Book

This book is organized into chapters and sections as shown in Figure 1-1.

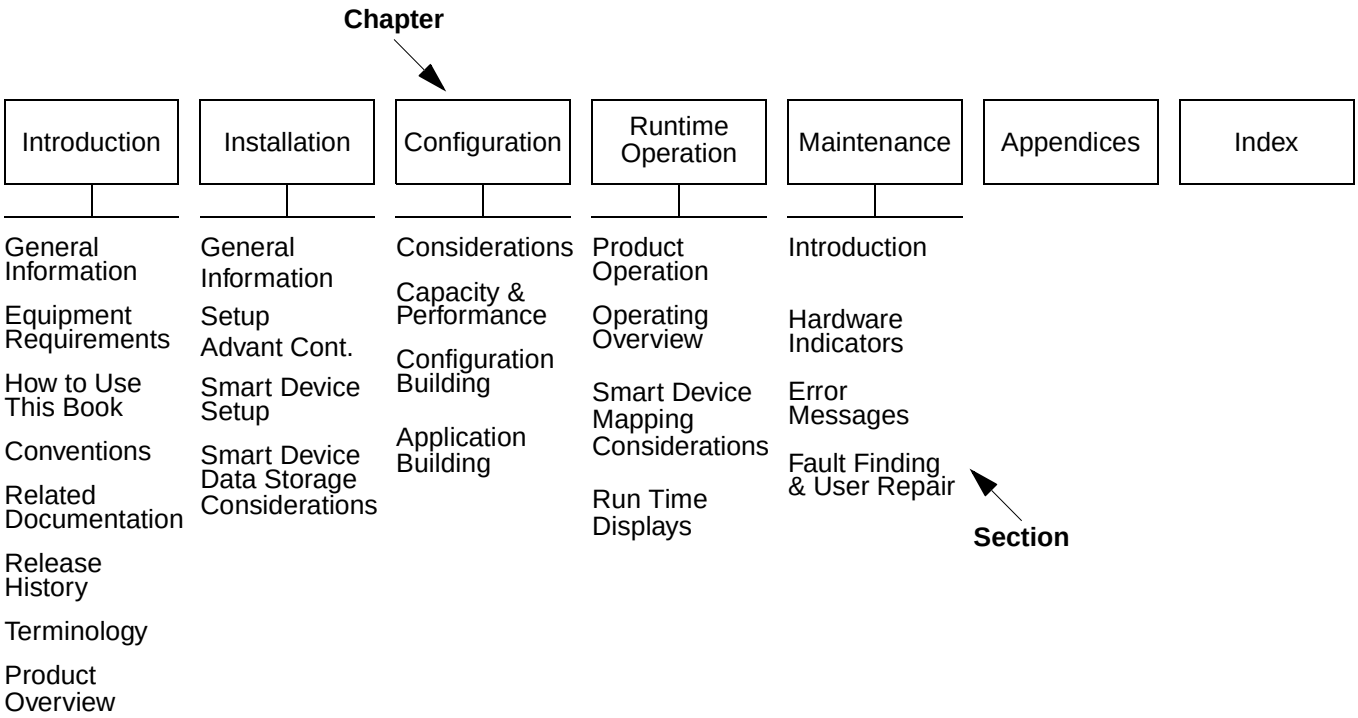

Figure 1-1. Organization of Manual

Chapter 1, Introduction presents an overview of the Advant Smart Device (Hart) Interface and its use within the Advant OCS.

Chapter 2, Installation, lists the types of smart devices supported, describes how to connect them to the Advant Controller, and gives specific configuration information for each type supported.

Chapter 3, Configuration explains how to set up the portion of the system data base that supports the interface. This portion includes items necessary to support communication between smart devices and Configurable Control Function (CCF) loops.

Chapter 4, Runtime Operation describes the operation of the Advant Smart Device (Hart) Interface.

Chapter 5, Maintenance explains configuration-related error codes returned by the smart device interface to the Advant OCS and reported as diagnostic messages.

1.4 Conventions

The following conventions are used throughout this manual for the presentation of material:

- The words in proper names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- The names of keyboard keys are boldfaced.
  - Initial capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, the **Return** key or **<Return>**.
  - Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the **space bar**, **comma key**, and so on.
  - In descriptions, the word "key" is used in conjunction with its name. For example, pressing the **Return** key initiates the process.
  - In tables and procedures, angle brackets replace the word "key." For example, press **<Return>**.
  - A dash is used to indicate that you must simultaneously press several keys. For example, **<CTRL-C>** indicates that you must hold down the **CTRL** key while pressing the **C** key.
  - The phrase "press and release" is used to indicate that you sequentially press several keys. For example, to count the hits in a Template Builder, press and release **<ESC>**, and then **<C>**. This indicates that you press and release the **ESC** key, and then you press and release the **C** key.
- The names of push and toggle buttons are boldfaced.
  - Initial capital letters are used for the name of a push or toggle button labeled on the display. For example, the **OK** button.
  - In descriptions, tables and procedures, the word "button" is used in conjunction with its name. For example, pressing the **OK** button initiates the process.
- The names of menus and menu items are boldfaced.
  - Initial capital letters are used for the name of menus listed in the menu bar. For example, the **File** menu.
  - Initial capital letters are used for the name of menu items. For example, to open a new window, choose **New** from the **File** menu.
- System prompts/messages are shown in the Courier font, and user responses/input are in the boldfaced Courier font. For example, if you enter a value out of range, the following message is displayed:

  ```
  Entered value is not valid. The value must be 0-30.
  ```

  In a tutorial, you may be told to enter the string TIC132 in a field. The string is shown as follows in the procedure:

  `TIC132`

1.5 Related Documentation

Other instruction books applicable to PC interface configuration include:

- *AdvaBuild Basic Functions User's Guide*
- *Configurable Control Functions (CCF)*
- *Advant Controller 410 User's Guide*
- *Advant Controller 460 User's Guide*

Also refer to the smart device manufacturer's documentation applicable to configuration.

1.6 Release History

Table 1-1 lists the major milestones in the development of Advant Smart Device (Hart) Interface.

Table 1-1. Release History

Version	Description
1.0	Advant Smart Device (Hart) Interface

1.7 Terminology

Object

An object is a logical representation of plant equipment, a location, documentation, or software function in the project database. For instance:

- A GENERICD object represents a subsystem in the Advant OCS
- a TSTRUC object represents an area in the plant
- a PI_DIA object represents a P&I diagram
- a PID object represents a PID algorithm

Definitions

- HART — Highway Addressable Remote Transmitter
- SHIM — Small HART Interface Module
- MVI — Multivendor Interface Board
- C1 — Carrier Module SC510 (used to hold MVI board)
- SI — Software Interface to the MVI board
- AC 410 — Advant Controller 410
- AC 460 — Advant Controller 460

- MTU Mounting Termination Unit for S800 I/O modules
- Connection Unit Field termination device for S100 I/O boards
- TRIO Taylor™ Remote I/O blocks

1.8 Product Overview

The Advant Smart Device (Hart) Interface is a software module resident in the CPU of the Advant Controller 410 (AC 410) and Advant Controller 460 (AC 460). It provides a method for CCF and TLL to have access to raw input values from a smart device, and a method for sending parameters to the smart device.

The Advant Smart Device (HART) Interface allows an Advant Controller to read or write data to smart devices or other compatible devices. Data is mapped into CCF points for control purposes.

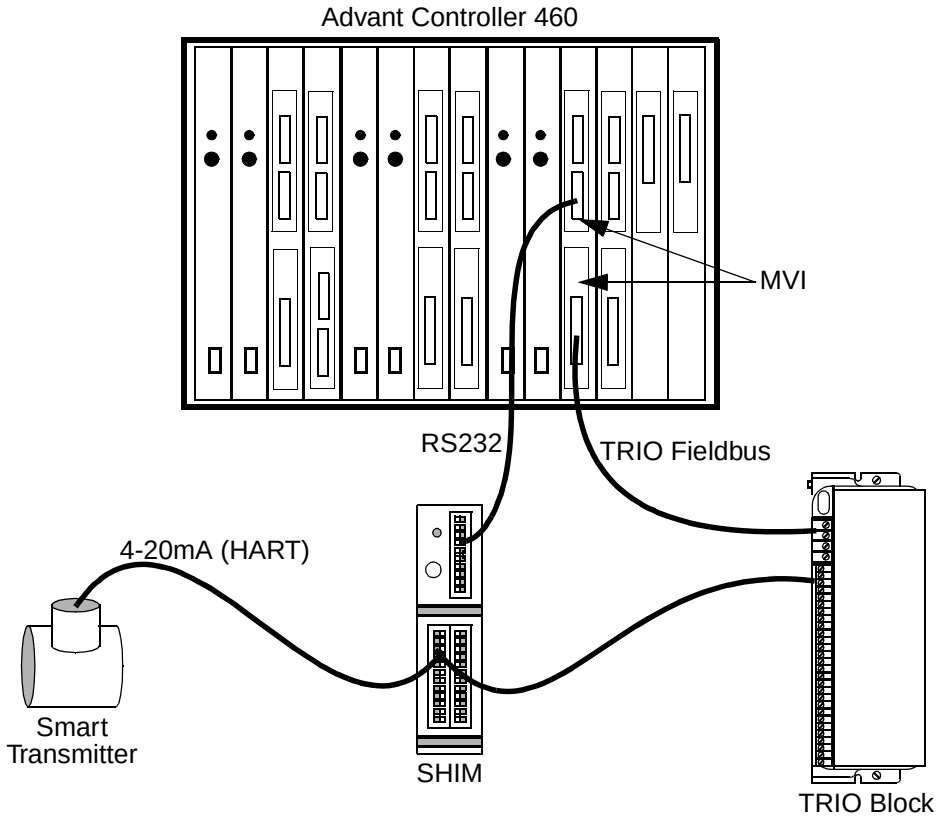

Figure 1-2. Advant Smart Device (HART) Interface Overview

The Smart Device Interface software provides digital signal processing of transmitter data from the field for diagnostic, monitoring and tuning functions, thereby allowing the operator or instrumentation technician to perform maintenance and tuning functions normally done in the field from the control room. Error reporting is also provided through the standard Advant OCS diagnostics to inform the operator of potential problems with a transmitter in the field.

Conventional transmitters communicate with the Advant OCS via a 4-20 mA analog signal proportional to the process variable being measured. This 4-20 mA signal requires analog to digital conversion for the digitally based Advant OCS host to measure, display and control the measured process variable. *Smart* devices (HART-compatible transmitters) can communicate with the Advant OCS via analog and digital signals. Analog signals from smart devices are communicated in the same manner as conventional devices, via a 4-20 mA signal. Smart devices digitally communicate range limits and maintenance information in addition to the process variable with the Advant OCS host via HART protocol using Frequency Shift Keying (FSK). Since the FSK signal does not compromise the 4-20 mA signal of a smart device, the analog (4-20 mA) signal and digital (FSK) signal for a smart device can co-exist on the same physical twisted pair of wires.

To convert the HART FSK current to voltage which the SHIM can read, a dropping resistor is used. The permitted range of the HART loop resistance is from 230 ohms to 1100 ohms. Typically, a 250 ohm resistor is used.

NOTE

If connection units (S100 I/O), MTUs (S800 I/O) or TRIO blocks are not used for SHIMs communicating only digital signals, a 250 ohm 1% 5W resistor is required to provide the 250 ohm loop resistance.

When both analog and digital communication with smart devices is desired, the analog signal is brought to the Advant controller using either S100 I/O, S800 I/O or Taylor™ Remote I/O (TRIO). Digital signals from up to four or eight smart devices are AC coupled from the smart devices using a SHIM purchased from Arcom Control Systems, Inc. The SHIM facilitates communication between the smart devices and the Advant OCS by converting the HART protocol used by the smart devices to the ModbusB protocol used by the Advant OCS. The SHIM also converts the HART protocol physical/link layers signals to RS-232 (optionally to RS-485 with converter) signal levels respectively used for Advant Controller serial communication.

An AC410 node can be equipped with either one or two CI532V02 ModbusB Multi-vendor Interface(s) (MVI), which have two ports each. Each RS-232 port is provided by connection between these modules, a SHIM, and up to eight smart devices connected to each SHIM. If an RS-232 to 485 converter is used, then up to 31 SHIMs can be connected to a port with up to eight smart devices connected to each SHIM, depending on performance requirements.

An AC 460 node can have up to three redundant PM510 CPU sets with up four CI532V02 ModbusB Multi-vendor Interface(s) (MVI) per PM510 CPU set. Each RS-232 port is provided by connection between these modules, a SHIM, and up to eight smart devices connected to each SHIM. If an RS-232 to 485 converter is used, then up to 31 SHIMs can be connected to a port with up to eight smart devices connected to each SHIM, depending on performance requirements.

NOTE

Communications redundancy for the Smart Device Interface is not available, therefore, there is no automatic port switching upon failure of the Advant OCS to SHIM connection.

The data base used by the interface is downloaded when the interface is powered-up or reset. After a Smart Device Interface configuration is downloaded, data tables (CCF channel tables) are allocated for analog and digital input values read from the smart devices. Channel assignments relate to a particular smart device 16-bit word (register) or 1-bit (coil) instead of hardware connections.

Periodic scanning of the smart device data by the SHIM commences at a rate of three times per second. During a scan, commands requesting data are sent to each smart device. More than one command may be required in order to read all required data. Information concerning what and how much data is read is obtained from Smart Device Interface configuration tables. If a hand-held monitor is placed on-line with a smart device, the rate at which the SHIM scans smart device data drops to one time per second.

The smart devices respond to each command by sending back the requested data. The smart device configuration then specifies how the smart device data is stored in the CCF control loop. Figure 1-1 shows an example of the smart device/CCF communication scheme. CCF accesses values read from smart devices based on the input channel specified for each loop.

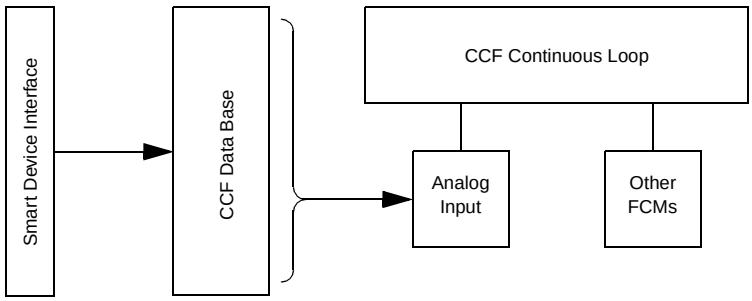

Figure 1-1. Smart Device/CCF Loop Communication Scheme

When a smart device fails to respond to two consecutive commands, a message is generated informing the operator of a smart device communications failure and the data qualities of loops associated with the smart device are set to BAD. The software continues to attempt to communicate with the smart device without generating further messages.

No communication is initiated by a smart device. Only responses to Advant OCS initiated commands are accepted.

Transfer of smart device variables to the Advant OCS data base via CCF loops that receive the variables can provide the following functions within the Advant OCS:

- Processing of smart device variables by the CCF loops that receive them, or by other CCF loops.
- Trending of smart device variables.
- Interaction with TCL programs.
- Inclusion of smart device variables in reports produced by the Report Services software.
- Inclusion of smart device variables in displays produced by the Display Builder software.
- Storing of smart device variables by the Historical Services software.
- Generation and logging of alarms for smart device variables.

Chapter 2 Installation

2.1 General Information

The Advant Smart Device (HART) Interface can run in an Advant Controller and supports communication to smart devices. Different models of smart devices are supported depending on the subsystem configuration. Information about the Advant Controller configurations supported by the Advant Smart Device (HART) Interface and the smart devices they support is provided in the sections that follow.

2.2 Setup

The Advant Controller communicates via RS-232 serial connections to smart devices. The smart devices are connected to an Arcom Control Products SHIM-4 or SHIM-8. The SHIMs are then either connected directly to the Advant Controller's MVI via an RS-232 connection or they are connected to either a Black Box IC108A RS-232 to RS-485/422 Converter Plus or a Westermo Teleindustri AB MA-42 Converter RS-232 to RS-485/422 which in turn is connected to the Advant Controller.

Arcom Control Systems, Black Box and Westermo contact information follows:

Table 2-1. Arcom Control Systems Inc. Contact Information

Arcom Control Systems Inc. 13510 South Oak Street Kansas City, MO 248145
(816) 941-7025 Voice
(816) 941-0343 FAX

Table 2-2. Black Box Contact Information

Black Box P.O. Box 12800 Pittsburgh, PA 15241
(412) 746-5500 Voice Order Line 7AM to 8PM ET M-F 8AM to 4PM ET Sat.
(800) 321-0746 FAX - 24 hours
(412) 746-0746 FAX - 24 hours
http://www.blackbox.com

Table 2-3. Westermo Teleindustri Contact Information

Westermo Teleindustri AB S-640 40 Stora Sundby Sweden
+46 16 61200 Voice +46 16 61180 FAX
Has distributors in: Norway, Finland, Denmark, Austria, Belgium, France, Netherlands, Switzerland, Germany, Great Britain & Italy.

Table 2-4 lists the smart devices supported in an Advant Controller.

Table 2-4. Smart Devices Supported in an Advant Controller

Manufacturer/Model	Communication Protocol	Connection
ABB Instruments Inc.		
KSC/1K1322010030 Differential Pressure	ModbusB	Point to point
Rosemont		
1151 Differential Pressure 3044C Temperature 3051C Differential Pressure	ModbusB	Point to point

NOTE

The smart devices listed in Table 2-4 are subject to change without notice

2.2.1 Connecting to an Advant Controller 410 Subsystem

The paragraphs that follow describe the serial ports of an Advant Controller 410 (AC410) and how to connect a smart device to them.

AC410 Ports

The serial ports of an AC410 are provided by the MVI module which is installed in the PM150 CPU. A PM150 can contain one or two of the MVI modules. Each MVI module uses one submodule position, and provides two serial ports. MVI module 1 contains serial ports 3/1 and 3/2, and MVI module 2 contains ports 4/3 and 4/4.

The communications protocol must be the same for both ports on the same MVI submodule.

Separate versions of the MVI support specific communication protocols. The communications protocols are implemented in firmware on the MVI module. Therefore, the appropriate protocol must be specified when ordering the MVI option.

2.2.1.1 CI532V02, MVI for ModbusB(inary)

The CI532V02 MVI module (used for the smart device interface) shown in Figure 2-1 contains two 9-pin male connectors. The pin designations for the connectors are listed in Table 2-5. The SHIMs (or RS-232/485 converters) are connected to the CI532V02 MVI module via RS-232 serial cables with a 9-pin connector.

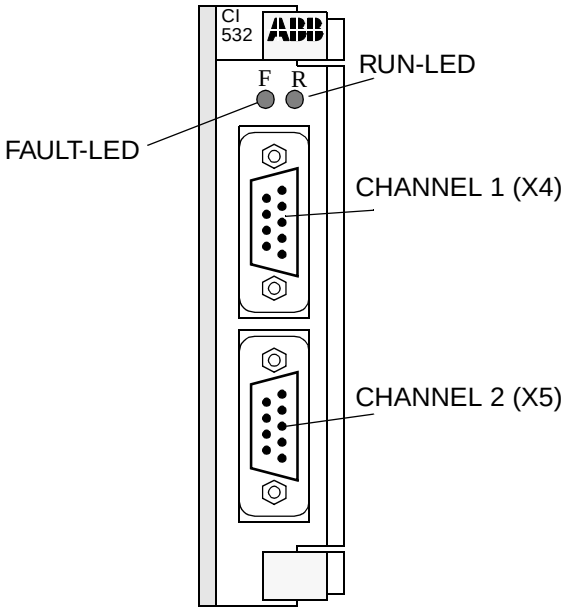

Figure 2-1. CI532V02 MVI Module

The CI532V02 MVI Module does not have any user jumper that need to be set.

Table 2-5. Pin Designation for Channel 1 and 2, Connector X4 and X5

Pin	Name	Description
1	DCD	Data Carrier Detect
2	RD	Receive Data
3	TD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	RI	Ring Indicator

MVI to SHIM (RS-232) for an Advant Controller 410

For RS-232 communication, an MVI serial port is connected to a single SHIM in a point-to point fashion using a single RS-232 cable as shown in Figure 2-2. Each SHIM can be connected to as many as 8 HART transmitters.

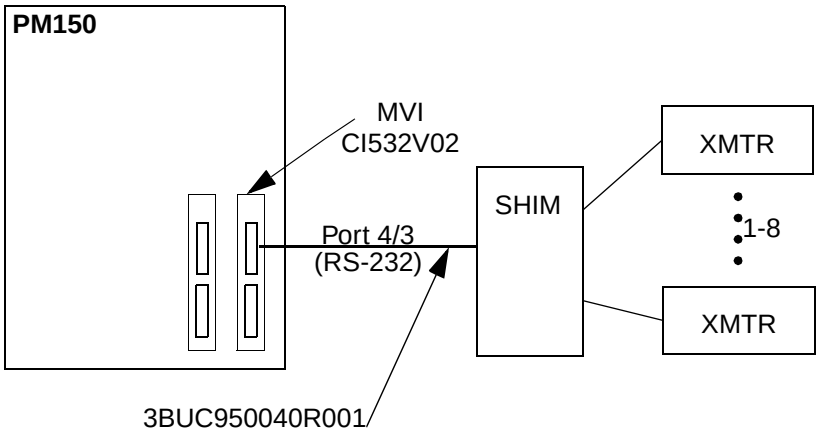

Figure 2-2. RS-232 Communications to a Smart Device in an AC410

Up to 4 SHIMs can be connected to the MVIs of the PM150.

The MVI is configured:

- 9600 baud, 8N1 (8 data bits, no parity, 1 stop bit), full-duplex.

The 3BUC950040R001 cable (8 meters) between the MVI serial port (RS-232) and the SHIM-8 has the following pin assignments:

Table 2-6. MVI Serial Port to SHIM Cable, 3BUC950040R001

MVI DTE 9-pin Female D connector	SHIM XTB1 (unterminated)	Description
1,4	-	DCD is jumpered to DTR
2	3	RD
3	4	TD
	5,6	
5	7	GND
6,7,8	-	RTS is jumpered to DSR and CTS

Figure 2-3 shows an example of the 3BUC950040R0001 cable used to connect a SHIM device to an Advant Controller via the 9-pin connector on the MVI module.

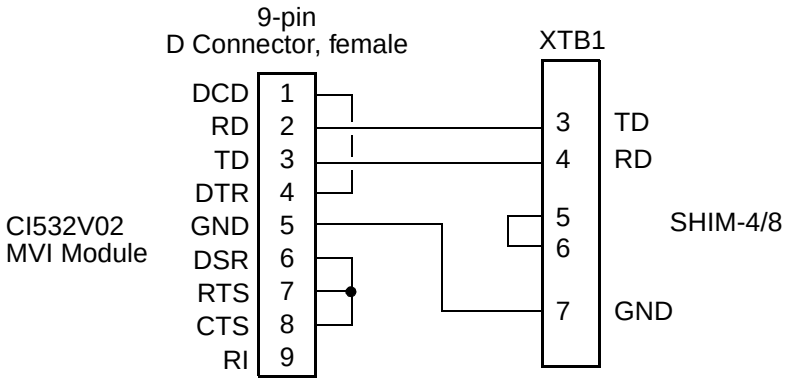

Figure 2-3. 3BUC950040R0001 Cable for Connecting a SHIM to the CI532V02 MVI

The SHIM-4/8 is also configured to be 9600 baud, 8N1 which is its default setting. The SW2 1-8 settings are OFF, OFF, ON, OFF, ON, ON, OFF, OFF.

The SHIM PROM is version 3.03 or later. Always refer to the documentation that comes with the equipment for more information.

MVI to RS-232/485 Converter to SHIM (RS-485) for an Advant Controller 410

This configuration is used to connect an MVI serial port to as many as 31 SHIMs in a multi-drop fashion using an RS-232/485 converter. Each SHIM-8 can be connected to up to 8 HART transmitters for a total of 248 possible HART transmitters (Figure 2-4).

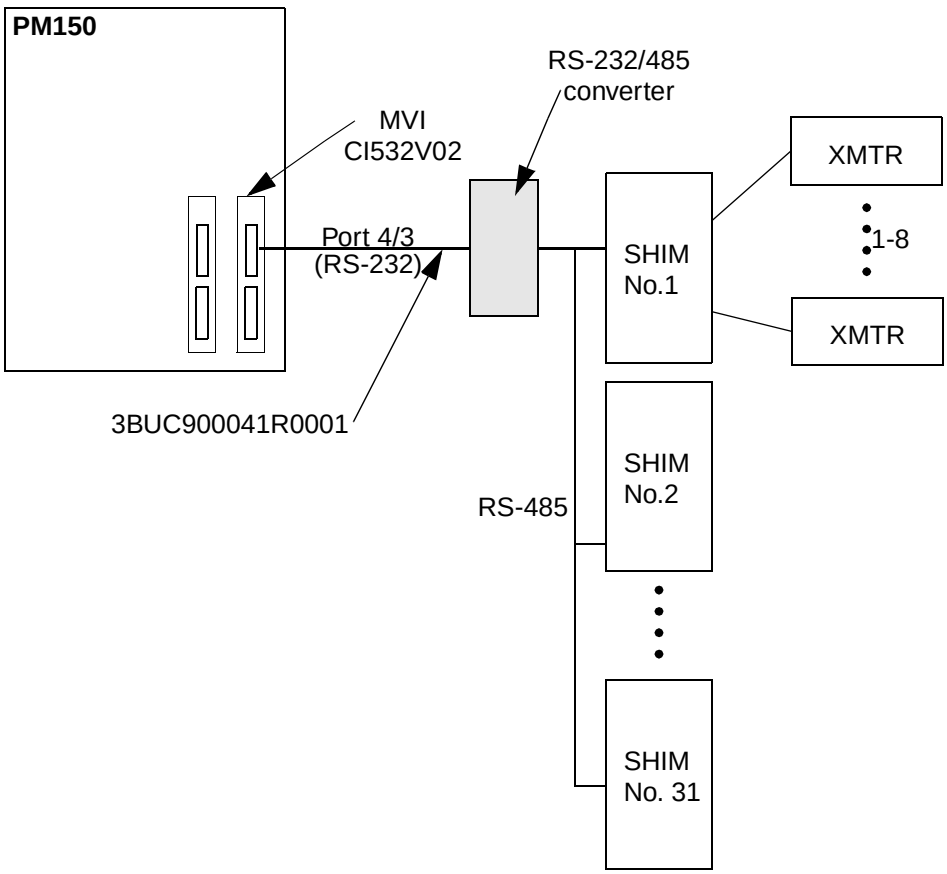

Figure 2-4. RS-232/485 Communications to a Smart Device in an AC410

Up to four RS-232/485 converters can be connected to the MVIs of the PM150.

The MVI is configured:

- 9600 baud, 8N1, half-duplex.

The 3BUC900041R0001 cable (8 meters) between the MVI serial port and the RS-232/485 converter has the following pin assignments:

Table 2-7. 3BUC900041R0001 MVI Serial Port to RS-232/485 Converter Cable

Description	MVI DTE(1) 9-pin Female D connector	RS-232/485 Converter 25-pin Male D connector
RD	2	3
TD	3	2
DTR	4	20
GND	5	7
DSR	6	6
RTS	7	4
CTS	8	5

(1) Pins 1 and 9 are not used/connected.

The Black Box IC108A is configured in the following manner:

Table 2-8. Black Box IC108A Set-up Requirements

Function	Switch/Jumper Settings
Configure RS-232 port as DCE	XW1 in position A
RTS/CTS/CD delay	W5 in position A-B
Signal ground not connected to frame ground	W7 is OUT
Half-duplex operation (2-wire)	W8 in position B-C
RTS/CTS delay - 0ms	W9 in position C
RS-485 driver is RS-232 RTS/CD enabled	W15 in position A-B
Half-duplex turnaround delay - 0.1ms	W16 in position B
RS-485 Driver Enable Hold - 7ms	W17 in position B
Normal Operation	S1 in OUT position
RS-485 Receiver Terminated	S2 in ON position
RS-485 Line Bias ON	S3 in ON position

Always refer to the documentation that comes with the equipment for more information.

The Westermo Teleindustri AB MA-42 is configured in the following manner:

Table 2-9. Westermo Teleindustri AB MA-42 Set-up Requirements

Function	Switch Settings
Selection of power source 115V/230V AC	S1 is set according to local AC requirement
Transmitter activated by RTS CTS controlled by RTS DCD controlled by RTS CTS Delay = 20ms	S2 1,4,6 = ON 2,3,5 = OFF
2-wire Line Connection and Termination	S3 2,5,6 = ON 1,3,4 = OFF

Always refer to the documentation that comes with the equipment for more information.

The twisted-pair RS-485 cable between the RS-232/485 converter and the first SHIM connection has the following pin assignments:

Table 2-10. RS-232/485 Converter to First SHIM Cable (RS-485)

Westermo Teleindustri AB MA-42 Line Connection (5-position screw terminal)	Black Box IC108A TB1 (unterminated)	SHIM XTB1 (unterminated)	Description
1,3	RxB, TxB	8	Data +
2,4	RxA, TxA	9	Data -

Each subsequent SHIM on the RS-485 bus is daisy-chained to each other using a twisted-pair wire connecting XTB1-8 to XTB1-8 and XTB1-9 to XTB1-9 of each SHIM.

The last SHIM in the RS-485 bus **must** have a 100-ohm 1/8W resistor inserted across XTB1-8 and XTB1-9 to terminate the RS-485 bus.

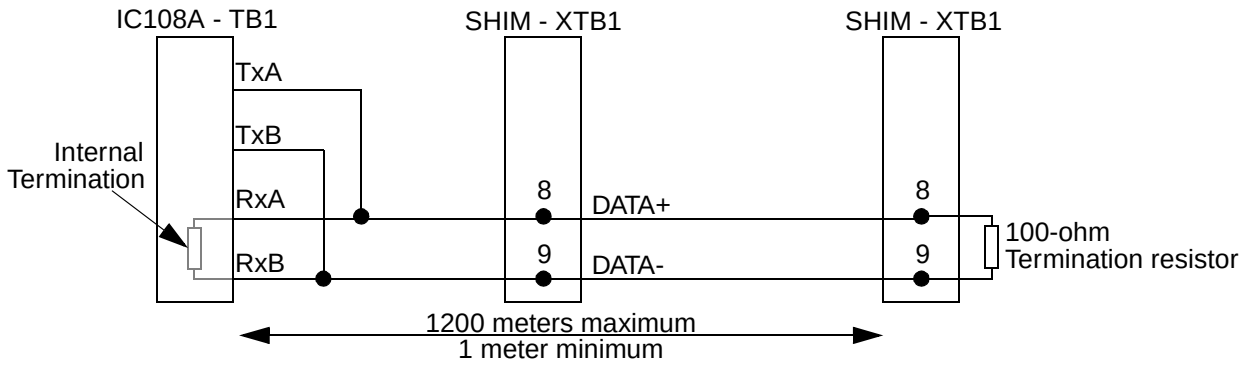

Figure 2-5. Black Box IC108A to SHIM RS-485 Wiring Diagram

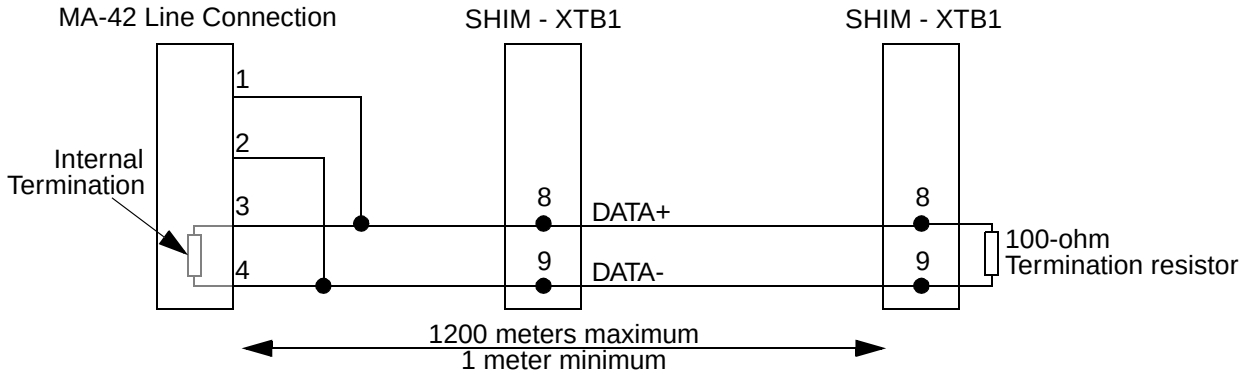

Figure 2-6. Westermo Teleindustri AB MA-42 to SHIM RS-485 Wiring Diagram

The SHIM-4/8 is also configured to be 9600 baud, 8N1 which is its default setting. The SW2 1-8 settings are OFF, OFF, ON, OFF, ON, ON, OFF, OFF.

The SHIM PROM version was 3.03.

Always refer to the documentation that comes with the equipment for more information.

The maximum length of the RS-485 bus is 1200 meters (3,937 feet) and the shortest possible drop (stub) length is 1 meter (3.3 feet).

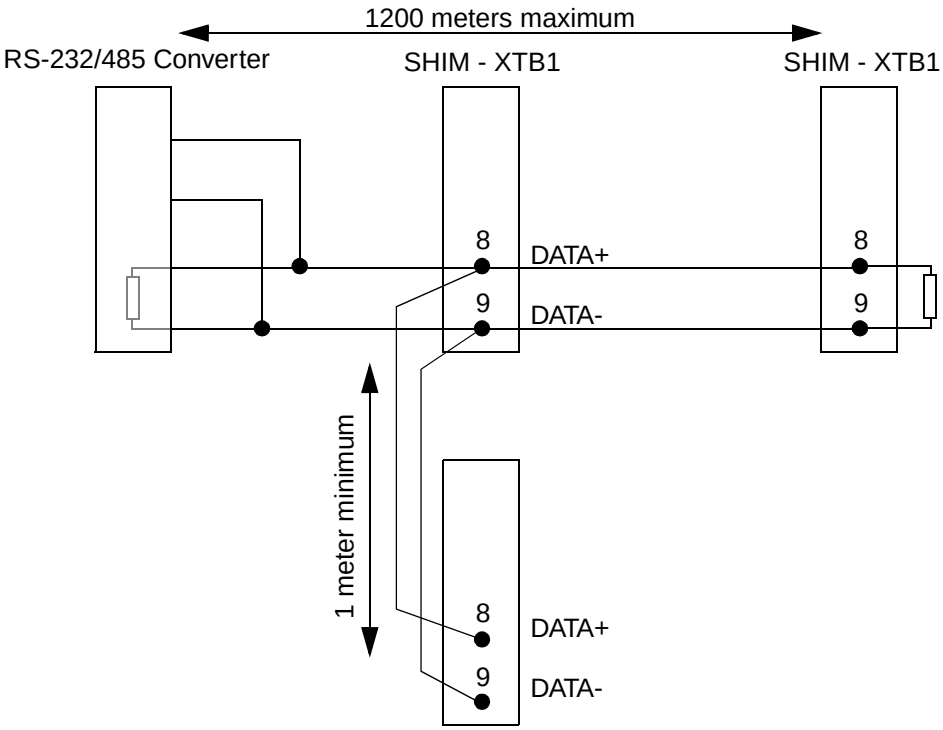

Figure 2-7. RS-485 Typical 2-Wire Connection Diagram

2.2.2 Connecting to an Advant Controller 460

The paragraphs that follow describe the serial ports of an Advant Controller 460 (AC460) and how to connect a smart device to them. The smart device interface can take advantage of CPU redundancy.

AC460 CPU Redundancy

The AC460 CPU (PM510) can be either non-redundant as shown in Figure 2-8, or it can use CPU redundancy as shown in Figure 2-9. If CPU redundancy is used, the backup CPU takes over processing if the primary CPU fails. All functions of the primary CPU including smart device support are handled by the backup CPU. Information about AC460 redundancy is provided in the *Advant Controller 460 User's Guide*.

NOTE

Redundancy of CPUs and smart device communications are independent functions. In the event of a takeover by the back-up CPU, there is no corresponding fail-over of the serial ports.

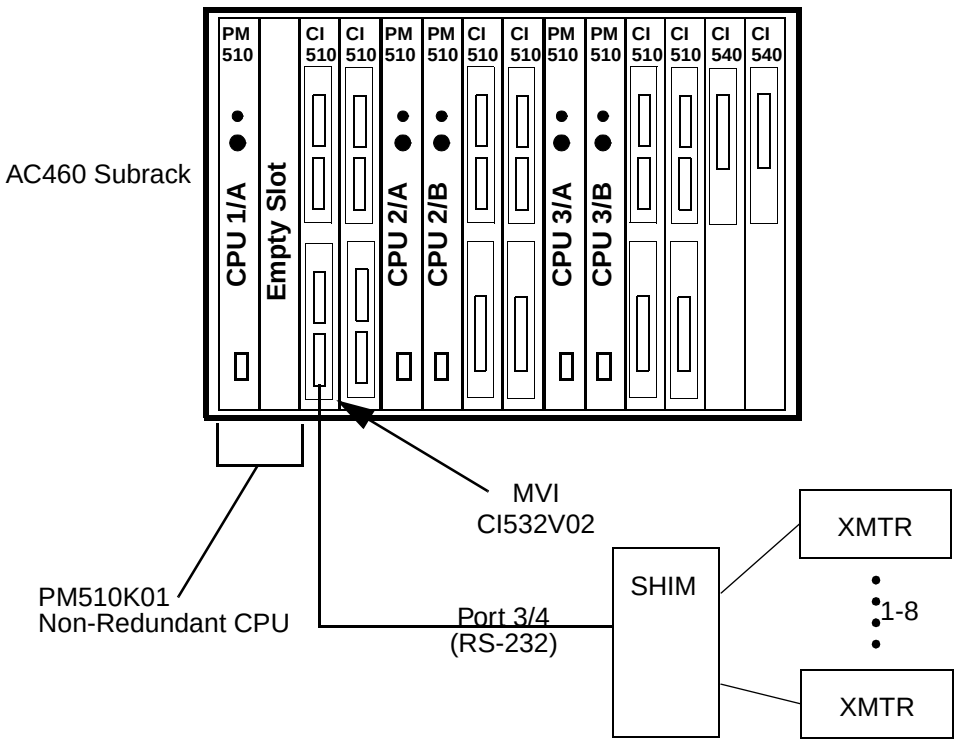

Figure 2-8. AC460 without PM510 CPU Redundancy

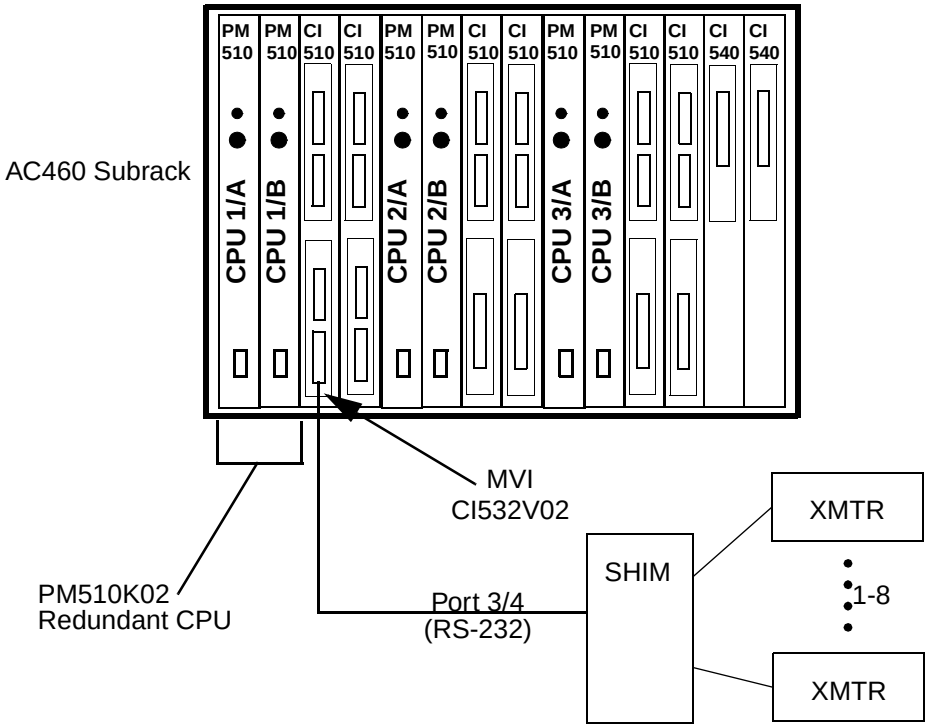

Figure 2-9. AC460 with PM510 CPU Redundancy

AC460 Serial Ports

The serial ports of an AC460 are provided by the MVI module. Each MVI has two serial ports that are set up for RS-232 communication. If the smart device uses a different electrical interface, a converter box must be provided.

Separate versions of the MVI support specific smart device protocols. The protocols are implemented in firmware on the MVI module. Therefore, the appropriate protocol must be specified when ordering the MVI option.

- CI532V02, MVI for ModbusB(inary)

The CI532V02 MVI module as shown in Figure 2-1 contains two 9-pin male connectors. The pin designations for the connectors are listed in Table 2-5. The SHIMs (or RS-232/485 converters) are connected to the CI532V02 MVI module via RS-232 serial cables with 9-pin connectors.

An Advant Controller 460 CPU (PM510) can support up to four MVI submodules for a total of eight serial ports, Figure 2-10.

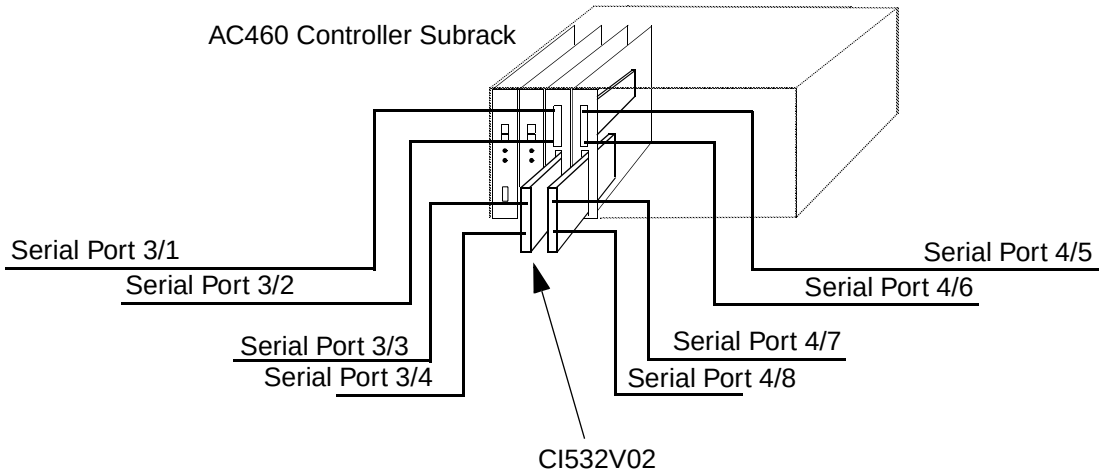

Figure 2-10. Advant Controller 460 Connection to MVI

MVI to SHIM (RS-232) for an Advant Controller 460

For RS-232 communication, an MVI serial port is connected to a single SHIM in a point-to point fashion using a single RS-232 cable as shown in Figure 2-11.

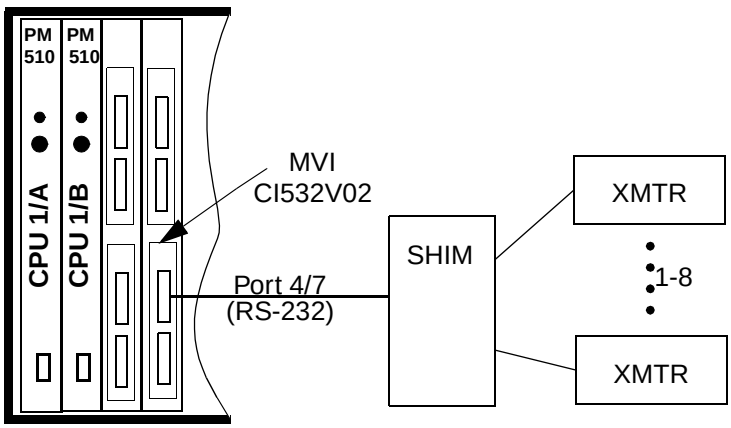

Figure 2-11. RS-232 Communications to a Smart Device in an AC460

Up to 8 SHIMs can be connected to each CPU of the AC 460.

The MVI settings, cabling, and SHIM settings are the same as for the AC 410.

MVI to RS-232/485 Converter to SHIM (RS-485) for an Advant Controller 460

This configuration is used to connect an MVI serial port to as many as 31 SHIM-8s in a multi-drop fashion using an RS-232/485 converter. Each SHIM-8 can be connected to up to 8 HART transmitters for a total of 248 possible HART transmitters (Figure 2-12).

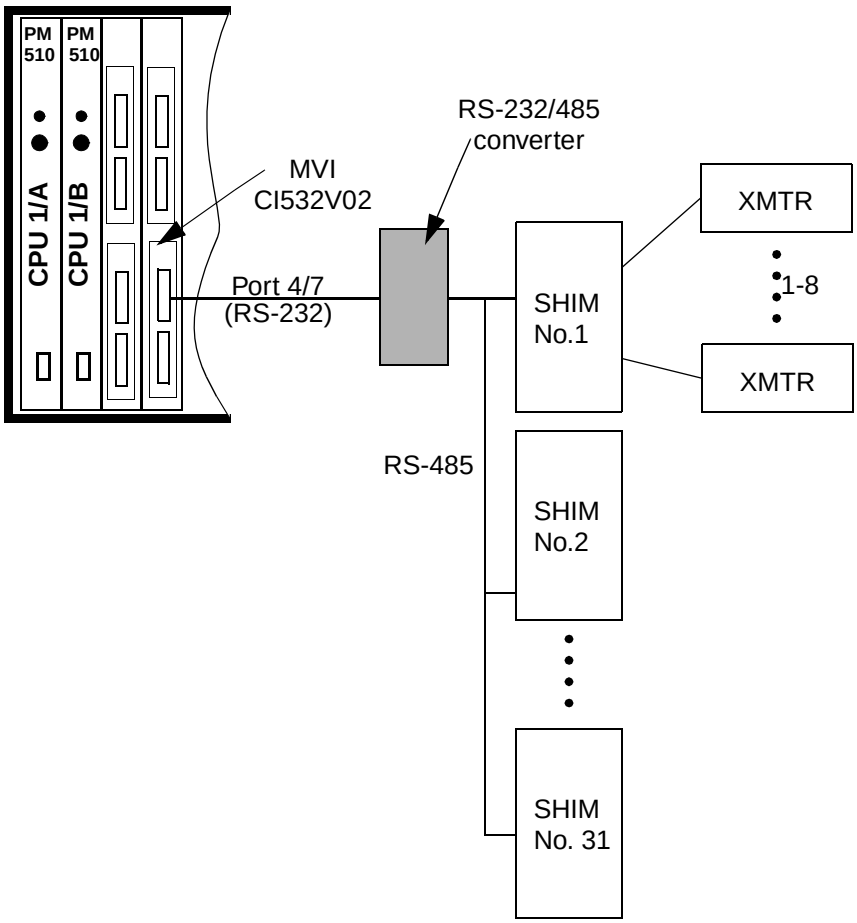

Figure 2-12. RS-232/485 Communications to a Smart Device in an AC460

Up to 8 RS-232/485 converters can be connected to each CPU of the AC 460.

The MVI settings, cabling, RS-232/485 converter settings and SHIM settings are the same as for the AC 410

2.3 Smart Device Setup

Prior to connecting smart devices to the Advant OCS, you must initially configure them using an external device such as a PC-based configuration package (not supplied with the Smart Device Interface) or a hand-held monitor like the ones shown in Figure 2-13 and 2-2 (Kent-Taylor KHT1 and Rosemount Model 268).

During initial configuration, you must specify the unique tag name and transmitter polling address for each smart device you want to connect to the Advant OCS. The tag name is used when establishing initial communication with a smart device to obtain its unique identifier. The transmitter polling address you specify for each smart device should be 0 (zero), allowing for the communication of both analog and digital signals by the smart device. If you specify an address other than 0, the analog signal is not generated with the digital signal. See the documentation for the PC-based configuration package or hand-held monitor you are using for instructions on how to configure smart devices.

NOTE

Hand-held monitors can later be used to tune smart devices in the field, however, any tuning changes made with the hand-held monitor are not logged by the Advant OCS.

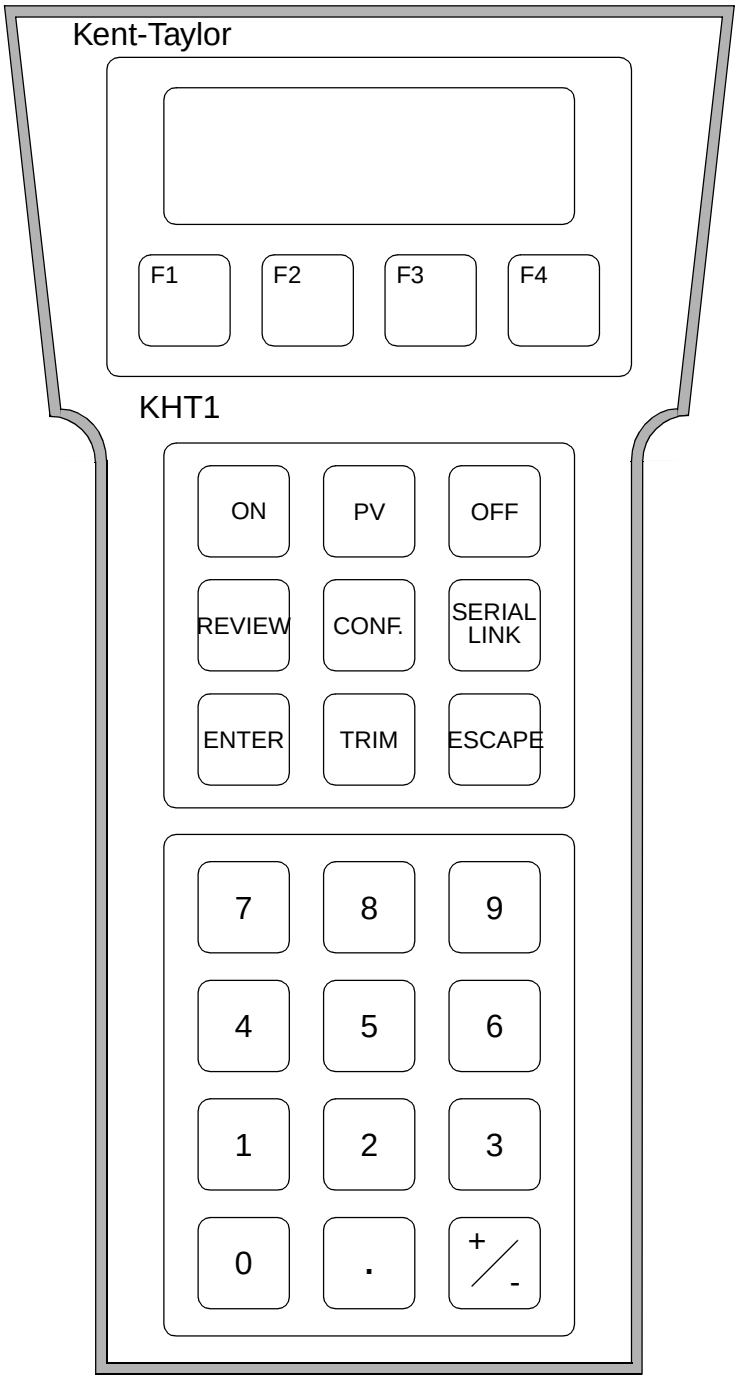

Figure 2-13. Kent-Taylor Hand Held Monitor

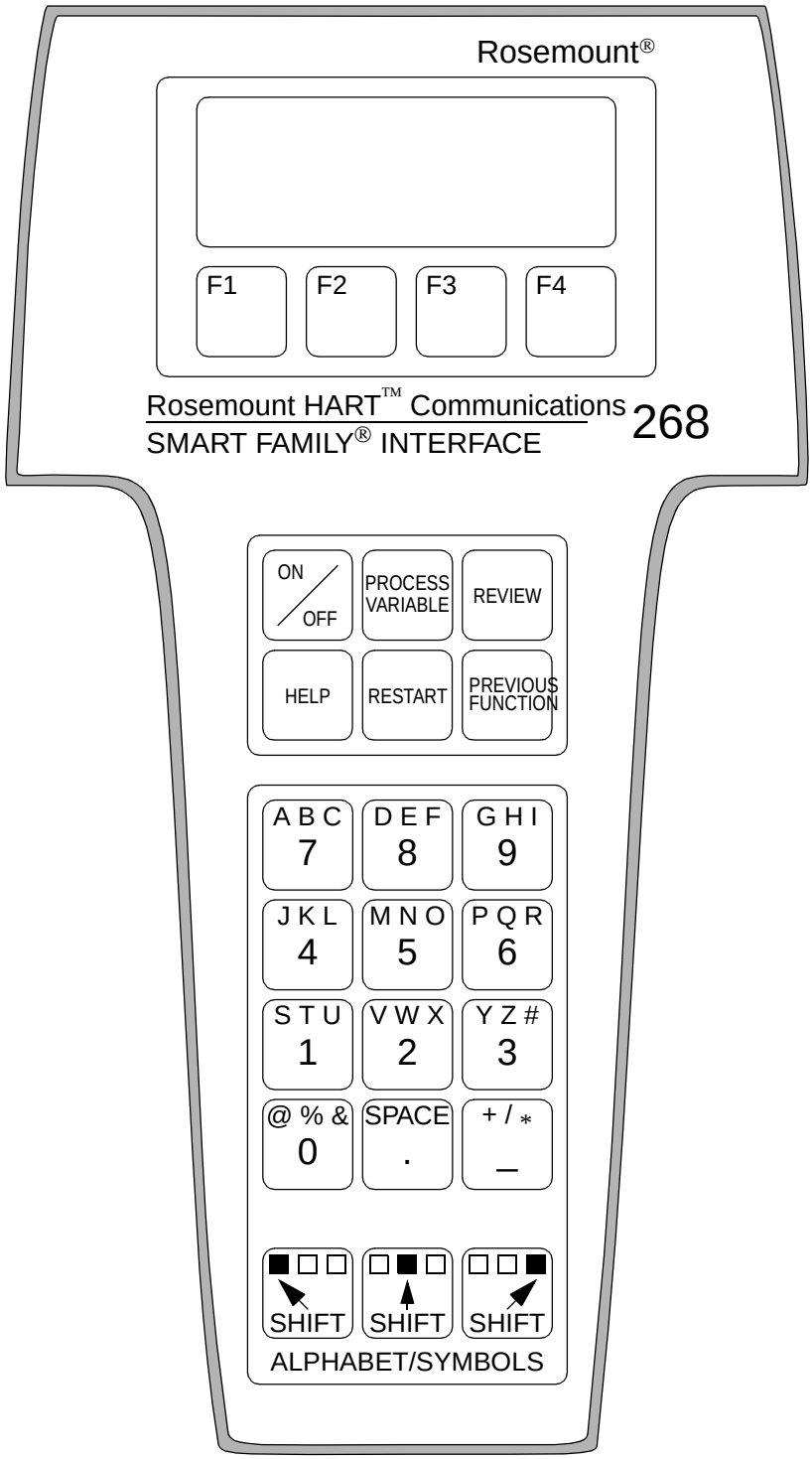

Figure 2-14. Rosemount HART Communications SMART FAMILY INTERFACE

2.3.1 Connecting to a SHIM

The MVI serial ports support ModbusB protocol. The smart devices use HART protocol. Therefore, to communicate information to the Advant Controller, the HART protocol of smart devices must be converted to ModbusB protocol. This conversion is provided by a Small HART Interface Module (SHIM).

The Smart Device Interface supports 2 SHIM models: SHIM-4 and SHIM-8. You can connect up to 4 smart devices to a SHIM-4 and up to 8 smart devices to a SHIM-8. In the remainder of this document, the term SHIM refers to either the SHIM-4 or SHIM-8. The terms SHIM-4 and SHIM-8 only are used to identify information specific to that model

Both the SHIM-4 and SHIM-8 have a 10-position terminal block (XTB1) and two 12-position terminal blocks (XTB2 and XTB3) as shown in Figure 2-15. However, there are no internal connections for the second 12-position terminal block (XTB3) on the SHIM-4.

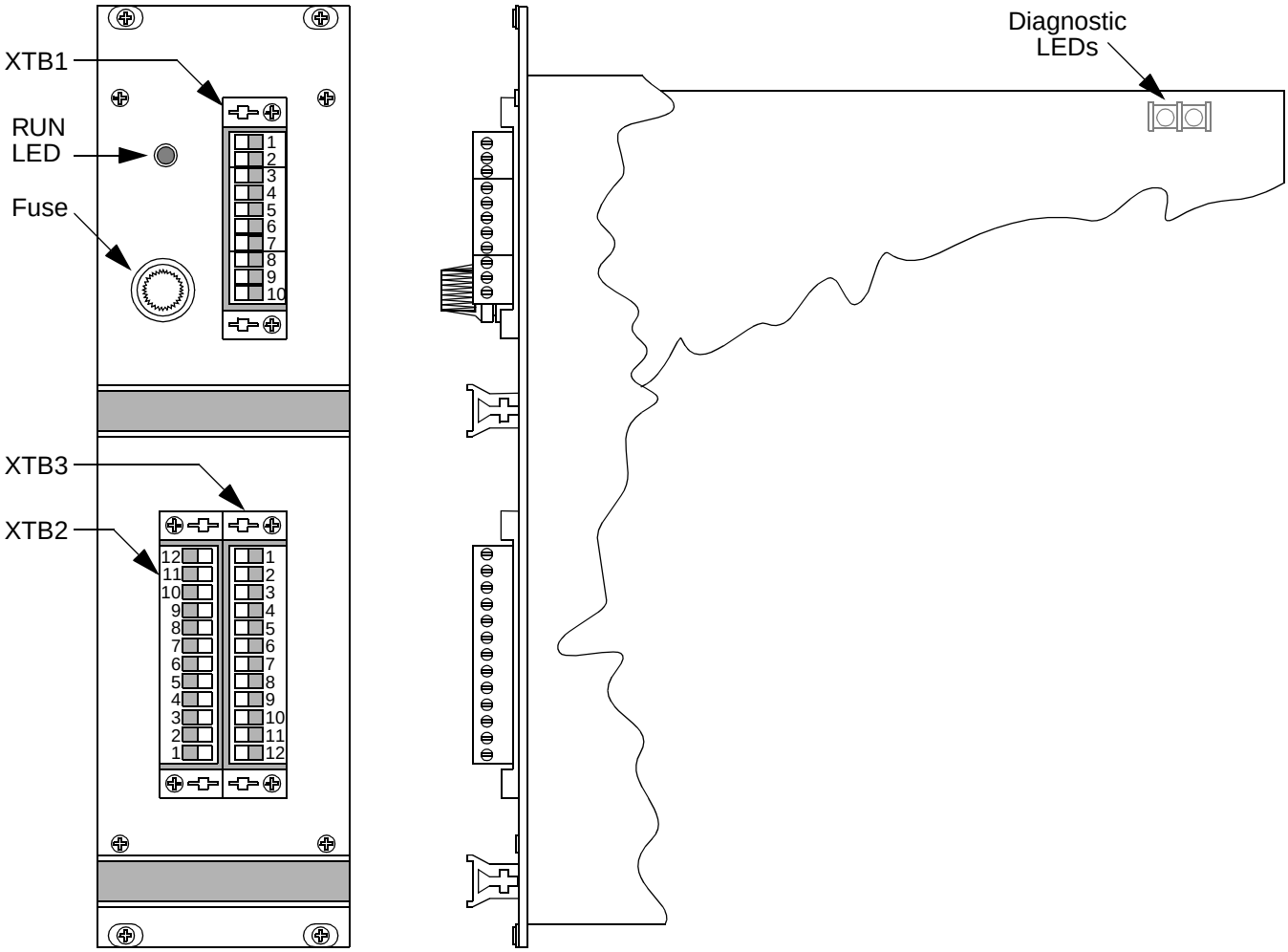

Figure 2-15. Front and Right Side View of SHIM

In addition to the terminal blocks on the SHIM's front panel, there is a red LED and a fuse. The LED flashes to signal that the SHIM passed its self test and is running. The fuse is a 0.5 Amp Excitation fuse which is shared by all smart devices connected to the SHIM to protect their Excitation connections. There are also two other red diagnostic LEDs visible from the top of the SHIM's housing. If either of these LEDs is flashing, an error has been detected. See Section 5.2, Hardware Indicators for information about the errors the diagnostic LEDs indicate.

Signal designations for the contact positions of the SHIM terminal blocks and their use are provided in Table 2-11.

Table 2-11. SHIM Terminal Block Designations

XTB1			XTB2			XTB3 (SHIM-8 ONLY)		
Contact	**Signal**	**Use**	**Contact**	**Signal**	**Use**	**Contact**	**Signal**	**Use**
1	+24 VDC	Power	12	EXCITATION	Smart Device 1	1	SIGNAL-	Smart Device 8
2	COM	Ground	11	SIGNAL+		2	SIGNAL+	
3	TX	RS-232 Serial Port	10	SIGNAL-		3	EXCITATION	
4	RX		9	EXCITATION	Smart Device 2	4	SIGNAL-	Smart Device 7
5	RTS		8	SIGNAL+		5	SIGNAL+	
6	CTS		7	SIGNAL-		6	EXCITATION	
7	COM		6	EXCITATION	Smart Device 3	7	SIGNAL-	Smart Device 6
8	DATA+	RS-485 Serial Port	5	SIGNAL+		8	SIGNAL+	
9	DATA-		4	SIGNAL-		9	EXCITATION	
10	COM		3	EXCITATION	Smart Device 4	10	SIGNAL-	Smart Device 5
			2	SIGNAL+		11	SIGNAL+	
			1	SIGNAL-		12	EXCITATION	

2.3.1.1 SHIM Power

SHIMs are powered by a small AC/DC power supply. The physical power and ground connections from the power supply are made at the screw terminations XTB1-1 and XTB1-2 of the SHIM as indicated in Table 2-11.

2.3.1.2 SHIM Serial Port Connections

As indicated in Table 2-11, terminal block XTB1 also has contacts for 2 serial ports which independently communicate ModbusB protocol using either RS-232 or RS-485. Connections between the MVI serial ports and the serial port contacts on a SHIM are made using either the 3BUC900040R0001 MVI to SHIM Interface Cable or 3BUC900041R0001 MVI to RS-232/485 Converter Interface Cable.

The 3BUC900040R0001 MVI to SHIM Interface Cable connects an MVI RS-232 port to a SHIM RS-232 serial port. Connection to the serial port is made with a female connector, and

connection to the SHIM RS-232 serial port is made using screw terminations XTB1-3, XTB1-4, and XTB1-7, see Figure 2-3.

NOTE

Contacts XTB1-5 and XTB1-6 of the SHIM RS-232 serial port support connection of a modem to the SHIM, and are jumpered together.

The 3BUC900041R0001 MVI to RS-232/485 Converter Interface Cable connects an MVI RS-232 port to the RS-232/485 converter. Cabling from the converter's RS-485 port to the RS-485 port of the first SHIM on the RS-485 Bus is not supplied by ABB. You can then daisy chain up to 31 SHIM RS-485 serial ports on a RS-485 Bus.

The SHIM to SHIM RS-485 serial port interconnections on the RS-485 Bus are shown in Table 2-12.

Table 2-12. SHIM to SHIM RS-485 Interconnections on RS-485 Bus

SHIM RS-485 Serial Port		SHIM RS-485 Serial Port	
Contact	**Signal**	**Contact**	**Signal**
XTB1-8	DATA +	XTB1-8	DATA +
XTB1-9	DATA -	XTB1-9	DATA -
NC	Shield	NC	Shield

NOTE

The SHIM RS-485 serial port contacts allow you to replace a SHIM without disrupting the RS-485 Bus.

2.3.1.3 Setting SHIM ModbusB Slave Address

Each SHIM connected on the RS-485 Bus must have a different ModbusB slave address. The SHIM ModbusB slave address is set on a 8-position DIP switch labeled S1 which is accessible from the back panel of the SHIM's 6U cassette housing as shown in Figure 2-16.

The first switch position (S1-1) has a binary weight of 1 when ON (towards the number on the DIP switch). The second through eighth switch positions (S1-2 through S1-8) have respective binary weights of 2, 4, 8, 16, 32, 64, and 128 when ON. If a switch position is OFF (away from the number on the DIP switch), it has a binary weight of 0. Only SHIM ModbusB slave addresses 1 through 31 are supported, therefore, only positions S1-1 through S1-5 are used to set SHIM ModbusB slave addresses and positions S1-6 through S1-8 are always set to OFF.

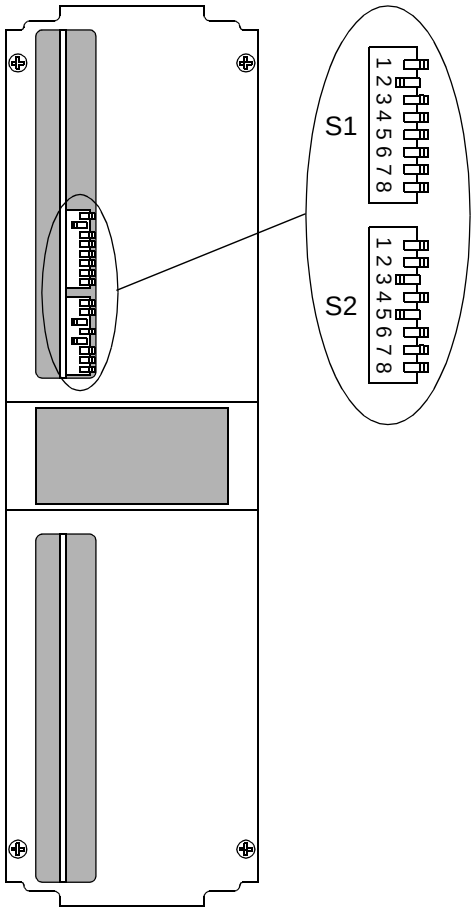

Figure 2-16. DIP Switches Accessible from Back Panel of SHIM

You can purchase SHIMs with their ModbusB slave addresses preset by ABB. The preset address is indicated on a sticker on the side of the SHIM's housing, thereby, allowing you to easily locate a particular SHIM in the field. If you purchased SHIMs *without* preset ModbusB slave addresses or you want to change a SHIM's address, set switch positions S1-1 through S1-5 to the ON or OFF setting that produces the desired address and write the address on the sticker on the side of the SHIM housing. For example, to set a SHIM's ModbusB slave address to 2, switch positions S1-1 through S1-5 are set to OFF, ON, OFF, OFF, and OFF, respectively. The SHIM in Figure 2-16 has a ModbusB slave address of 2.

2.3.1.4 Setting SHIM Parity and Baud Rate

HART protocol communicates smart device field data to the SHIM at 1200 baud, and ModbusB protocol communicates at 9600 baud. Therefore, to support ModbusB protocol for the communication of smart device field data to the Advant Controller, SHIM serial ports are configured at 9600 baud with no parity by default. The SHIM serial port baud rate and parity are

can be set on the 8-position DIP switch labeled S2 which is accessible from the back panel of the SHIM's housing as shown in Figure 2-16.

The first and second switch positions (S2-1 and S2-2) are set to OFF, indicating parity of None. The third through fifth switch positions (S2-3 through S2-5) are respectively set to ON, OFF, and ON, indicating a baud rate of 9600. Switch positions S2-6 through S2-8 are always set to OFF. Table 2-13 lists the switch position S2-1 through S2-5 settings and the parity and baud rate they set.

Table 2-13. DIP Switch Position S2-1 Through S2-5 Settings and Their Corresponding Parity and Baud Rates

Parity	S2-1	S2-2	Baud Rate	S2-3	S2-4	S2-5
None	OFF	OFF	300	OFF	OFF	OFF
Odd	OFF	ON	600	ON	OFF	OFF
Even	ON	OFF	1200	OFF	ON	OFF
Reserved	ON	ON	2400	ON	ON	OFF
			4800	OFF	OFF	ON
			9600	ON	OFF	ON
			19200	OFF	ON	ON
			Reserved	ON	ON	ON

2.3.1.5 Smart Device Connections

As indicated in Table 2-11, there are three contacts on SHIM terminal blocks XTB2 and XTB3 for each of the up to eight smart devices you can connect to a SHIM: Excitation, Signal+, and Signal-. Excitation connections are protected by a shared 0.5 Amp Excitation fuse located on the front panel, but there is no current limiting resistor or fuse per Excitation connection. Therefore, if a SHIM powers a smart device loop, an external 50 mA fuse is required on the corresponding SHIM Excitation to smart device Tx+ wire. Otherwise, a blown Excitation fuse takes down all smart device loops powered by the SHIM without affecting serial communication with the SHIM. Digital communication from smart devices is AC coupled to the SHIM on corresponding Signal+ connections, and all Signal- connections to the SHIM are internally shorted together to COM.

The physical connection between the screw terminations of a smart device and a SHIM is made using a cable referred to as a HART Bus. See Section 5.4.1.2, Smart Device Removal and Installation Procedures for specific installation and removal information.

NOTE

The maximum length of the HART Bus is 10,000 ft. (3,048 m) or is determined using the following formula, whichever is less:

$$L = 65{,}000{,}000 / (R \times C) - (C_f + 10{,}000) / C$$

where L is the length in feet or meters, R is the total loop resistance in ohms, C is the cable capacitance in pF/ft. or pF/m, and C_f is the sum of CN values of smart

devices multiplied by 5,000 pF. For smart devices without CN values, use 1. Masters (primary and secondary) need not be counted in deriving C_f.

2.3.1.6 Digital Signals Only

Digital signals of smart devices are brought into a Advant Controller via SHIMs connected to the MVI serial ports.

For digital communication only with smart transmitters, a SHIM can supply loop power to smart transmitter loops and provide digital communication to MVI port using RS-232 directly or for multiple SHIMs using the RS-485 bus through a RS-232/485 converter.

Since analog input termination panels are not used for digital only communication with smart devices connected to a SHIM, a 250 ohm 1% 5W resistor is required. This resistor is needed to provide the 250 ohm HART loop resistance that converts the HART FSK current to a voltage (1V to 5V) that the SHIM can read.

NOTE

In the field, you can tune a smart device communicating only digital signals to the Advant Controller by attaching a hand-held monitor to its smart transmitter loop using grapper hooks across its terminals or the resistor attached between its corresponding SHIM Signal+ and Signal- connections. Any tuning changes you make to the smart device with the hand-held monitor are not logged by the Advant OCS.

2.3.1.7 Analog and Digital Signals

Advant Controllers can support both analog and digital communication with smart devices or just digital communication as described above. The analog signal from a smart device is brought into the Advant Controller using either S100 I/O, S800 I/O or Taylor Remote I/O (TRIO). The digital signal from up to eight smart devices is AC coupled to the SHIM.

S100 I/O

Analog signals brought into an Advant Controller employing S100 I/O use either DSAI 130 Analog Input boards, DSAI 133 Analog Input boards or DSAX 110 Analog Input/Output Boards. The DSAI 130 has terminations for 16 analog inputs, the DSAI 133 has terminations for 32 analog inputs and the DSAX 110 has terminations for 8 analog inputs.

In the AC 410 the S100 I/O boards are installed in its subrack. Up to 15 boards can be installed in the AC 410 subrack. For the AC 460 the information from S100 I/O boards come from separate S100 I/O subracks. Up to 5 subracks can be connected to each CI540 S100 submodule installed in the AC 460. Please refer to the *S100 I/O User's Guide, Advant Controller 410 User's Guide*, and the *Advant Controller 460 User's Guide* for more information on S100 I/O connections.

Figure 2-17 shows an example of the connections for the AI board, DSAI 130, with 4-20mA inputs. The connection unit DSTA 131, used together with the DSAI 130 board, is provided with screw terminals to connect 16 analog input signals.

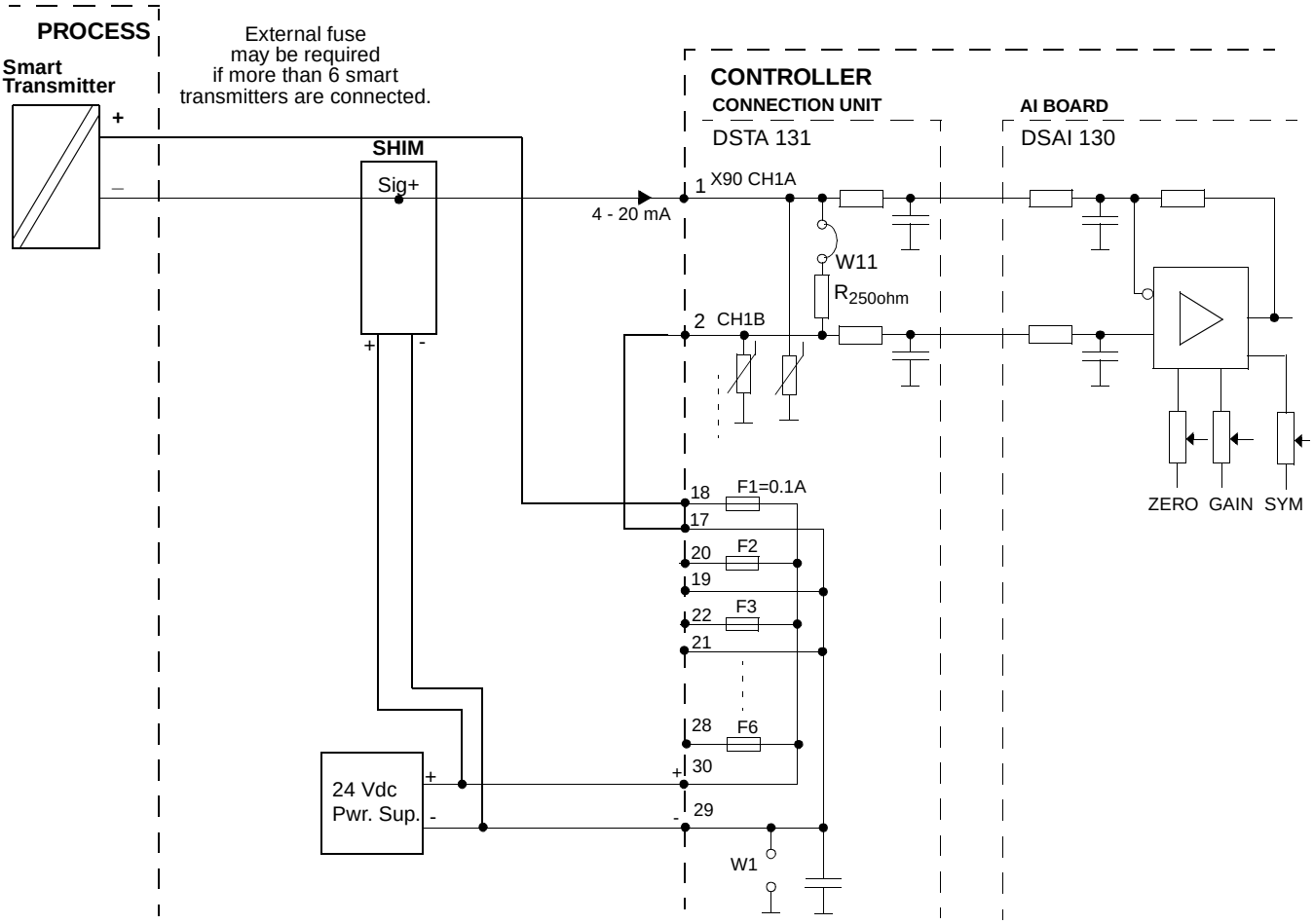

Figure 2-17. Connection of AI Board DSAI 130 to DSTA 131

Figure 2-18 shows an example of DSAI 130 board connected to the process with connection unit DSTA 133. The example illustrates a single channel connection of the transmitter. The connection unit DSTA 133 has 16 channels, of which eight are intended only for two-wire transmitter connection and eight are individually adaptable to two-, three- or four-wire transmitter connection. In all cases, the transmitters can be supplied power via a fuse on DSTA 133.

Figure 2-19 shows an example of the DSAI 133 board connected to the process with the connection unit DSTA 002. Use the connection unit DSTA 002 together with DSAI 133 to connect 16 unipolar, single-ended current or voltage signals. Two DSTA 002, for 32 channels, are used together with one DSAI 133. You can connect the connection unit to two DSAI 133 for redundancy. Each channel has a voltage output, protected with a PTC resistor, for transmitter power.

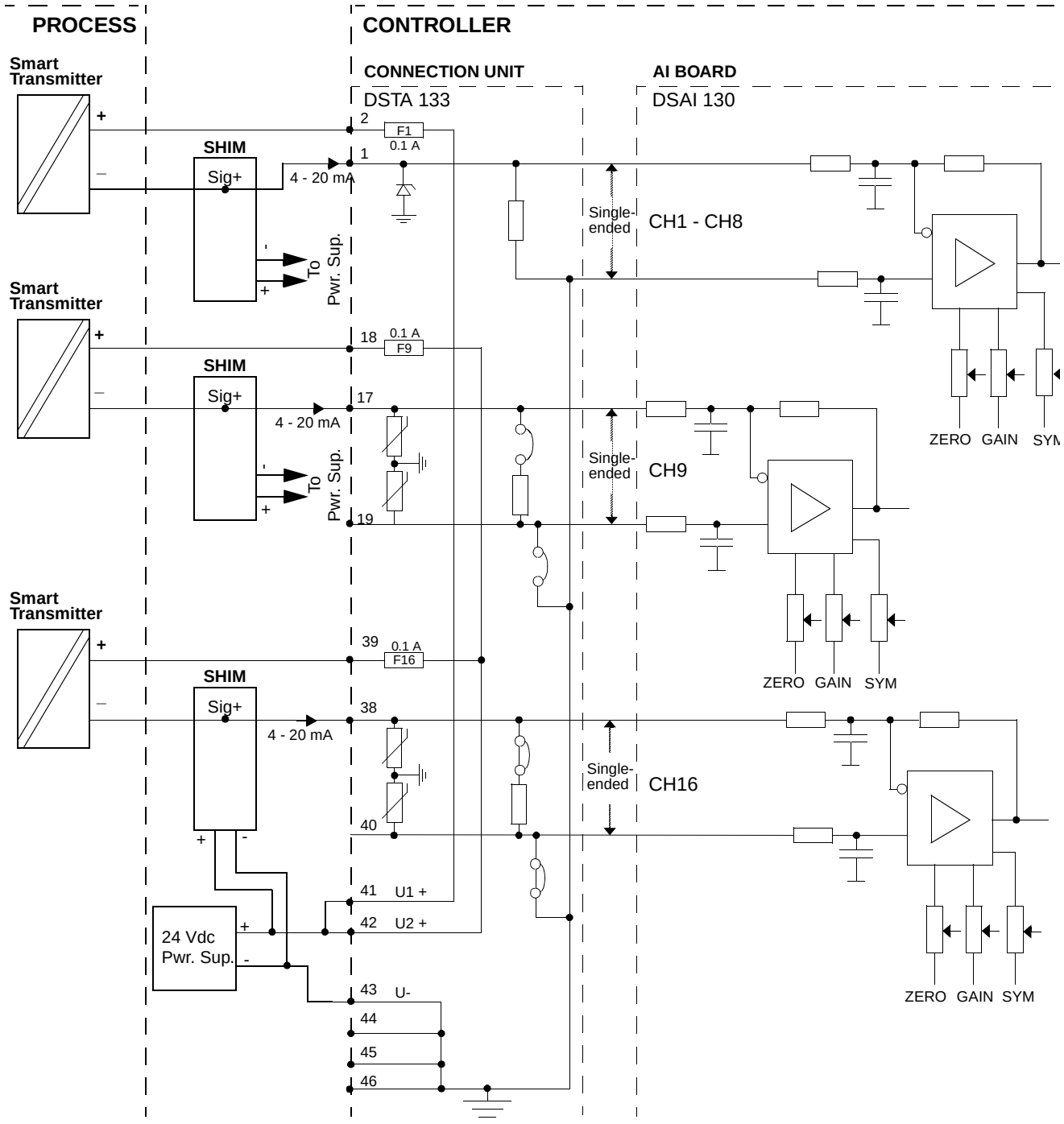

Figure 2-18. Connection of AI Board DSAI 130 to DSTA 133

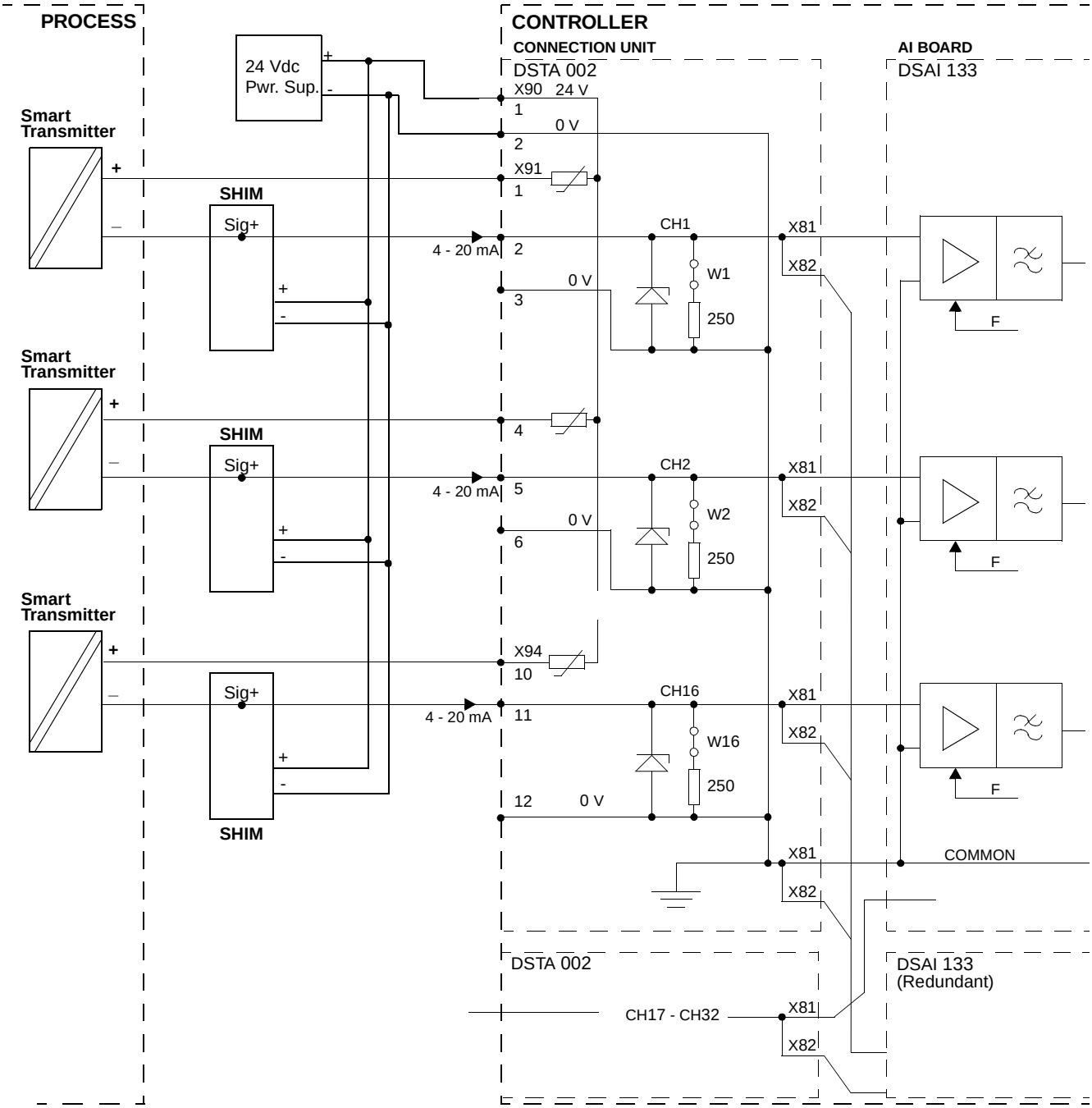

Figure 2-19. Single and Redundant Connections of DSAI 133 to DSTA 002

Figure 2-20 shows an example of the DSAX 110 board connected to the process with the connection unit DSTA 001. You can connect the connection unit to two DSAX 110 for redundancy.

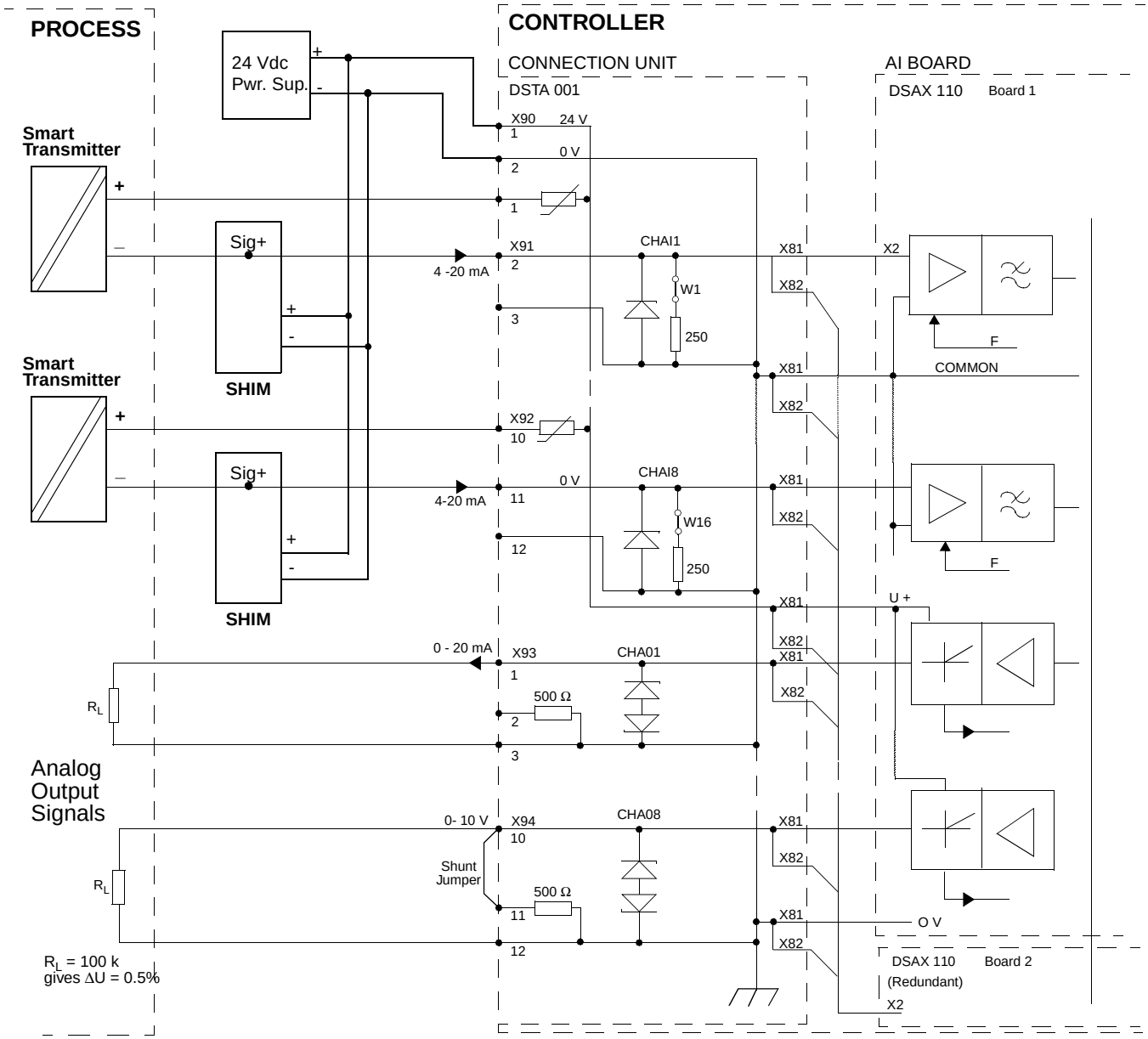

Figure 2-20. Connection of AI/O Board DSAX 110 to DSTA 001

S800 I/O

Analog signals brought into an Advant Controller employing S800 I/O use either AI810 Analog Input modules or AI820 Analog Input modules. The AI810 module has terminations for 8 analog inputs, and the AI820 has terminations for 4 analog inputs.

To communicate information from the S800 I/O modules to the Advant Controller, a CI520 Advant Fieldbus 100 (AF 100) submodule is required. The CI520 has connections to the Advant Fieldbus 100 modem that connects to the S800 I/O Stations. Up to 32 I/O Stations can be configured on one AF 100 segment and each S800 I/O Station can have up to 24 I/O modules. Please refer to the *S800 I/O User's Guide, Advant Fieldbus 100 User's Guide, Advant Controller 410 User's Guide* and the *Advant Controller 460 User's Guide* for more information on S800 I/O connections.

Figure 2-21 shows the process connections for the Analog Input Module AI810 when installed on the Extended MTU TU830.

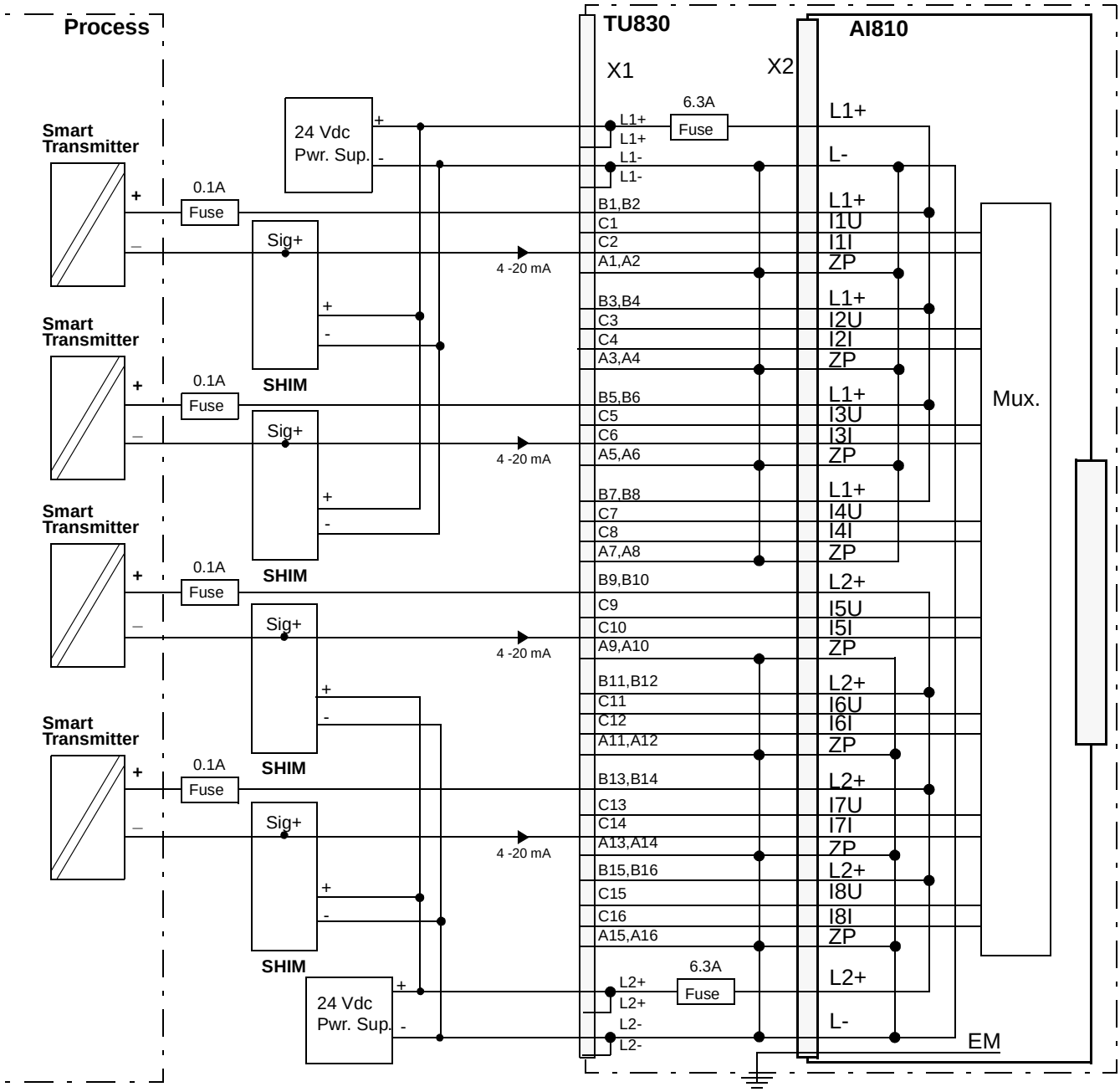

Figure 2-21. AI810 with Extended MTU (TU830) Process Connections

External fuses to each smart transmitter must be installed to protect the power to other SHIMs connected to the same power supply.

Figure 2-22 shows the process connections for the AI810 when installed on the Compact MTU TU810.

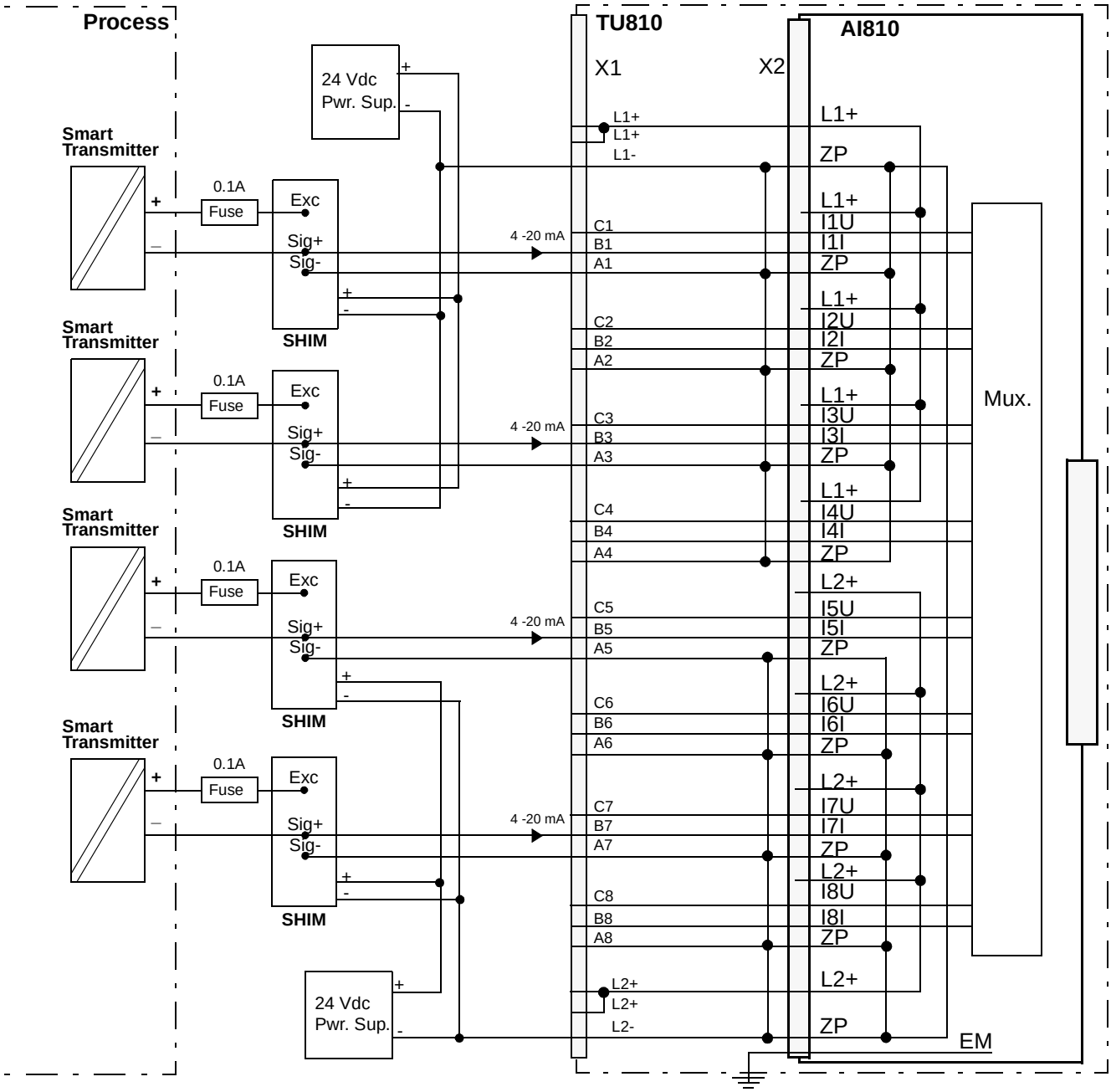

Figure 2-22. AI810 with Compact MTU (TU810) Process Connections

External fuses to each smart transmitter must be installed to protect the power to other SHIMs connected to the same power supply.

Figure 2-23 shows the process connections for the AI810 when installed on the Extended MTU TU835.

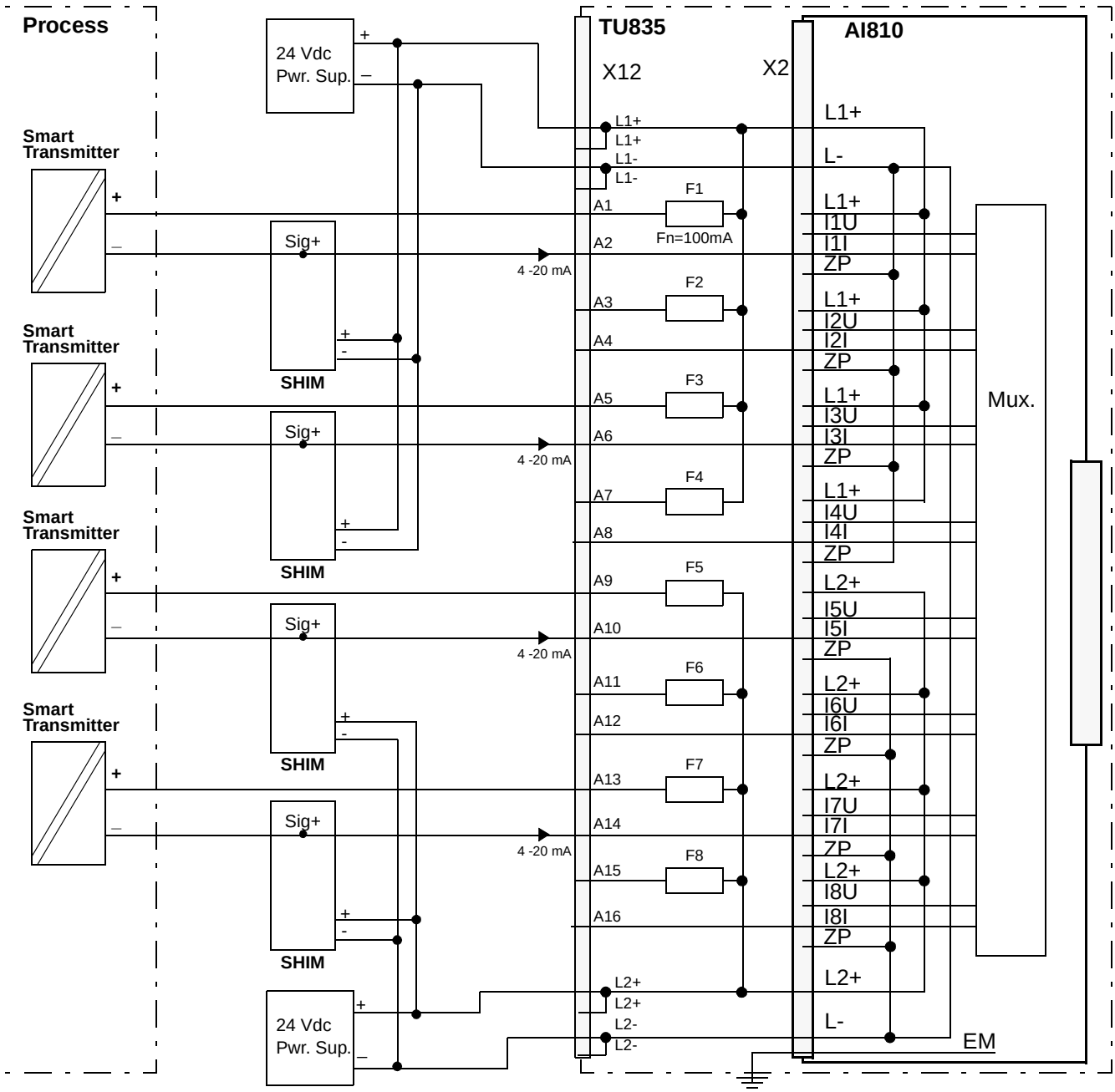

Figure 2-23. AI810 with Extended MTU (TU835) Process Connections

Figure 2-24 shows the process connections for the Differential Analog Input Module AI820 when installed on the Extended MTU TU830.

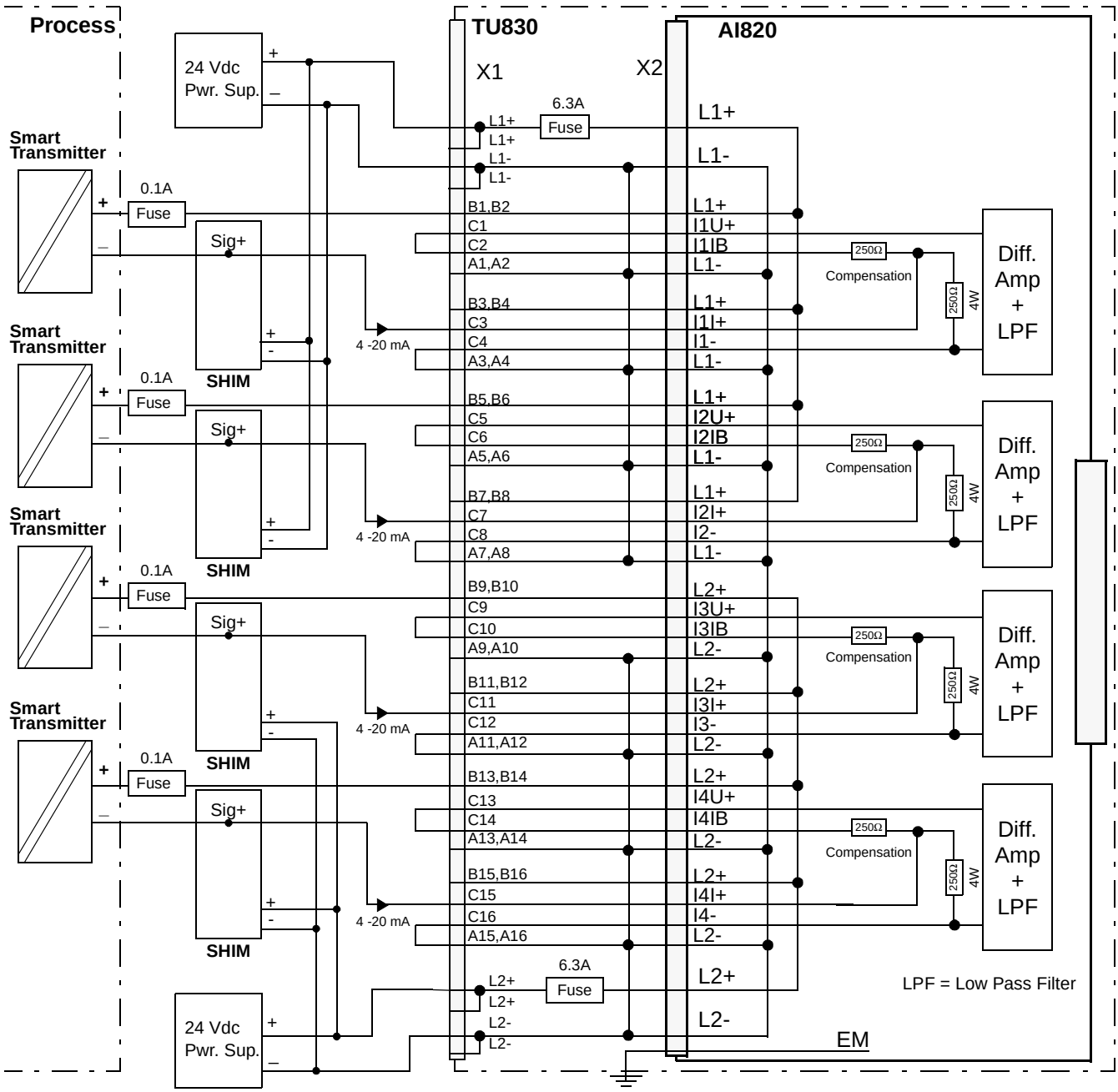

Figure 2-24. AI820 with Extended MTU (TU830) Process Connections

External fuses to each smart transmitter must be installed to protect the power to other SHIMs connected to the same power supply.

Figure 2-25 shows the process connections for the AI820 when installed on the Compact MTU TU810.

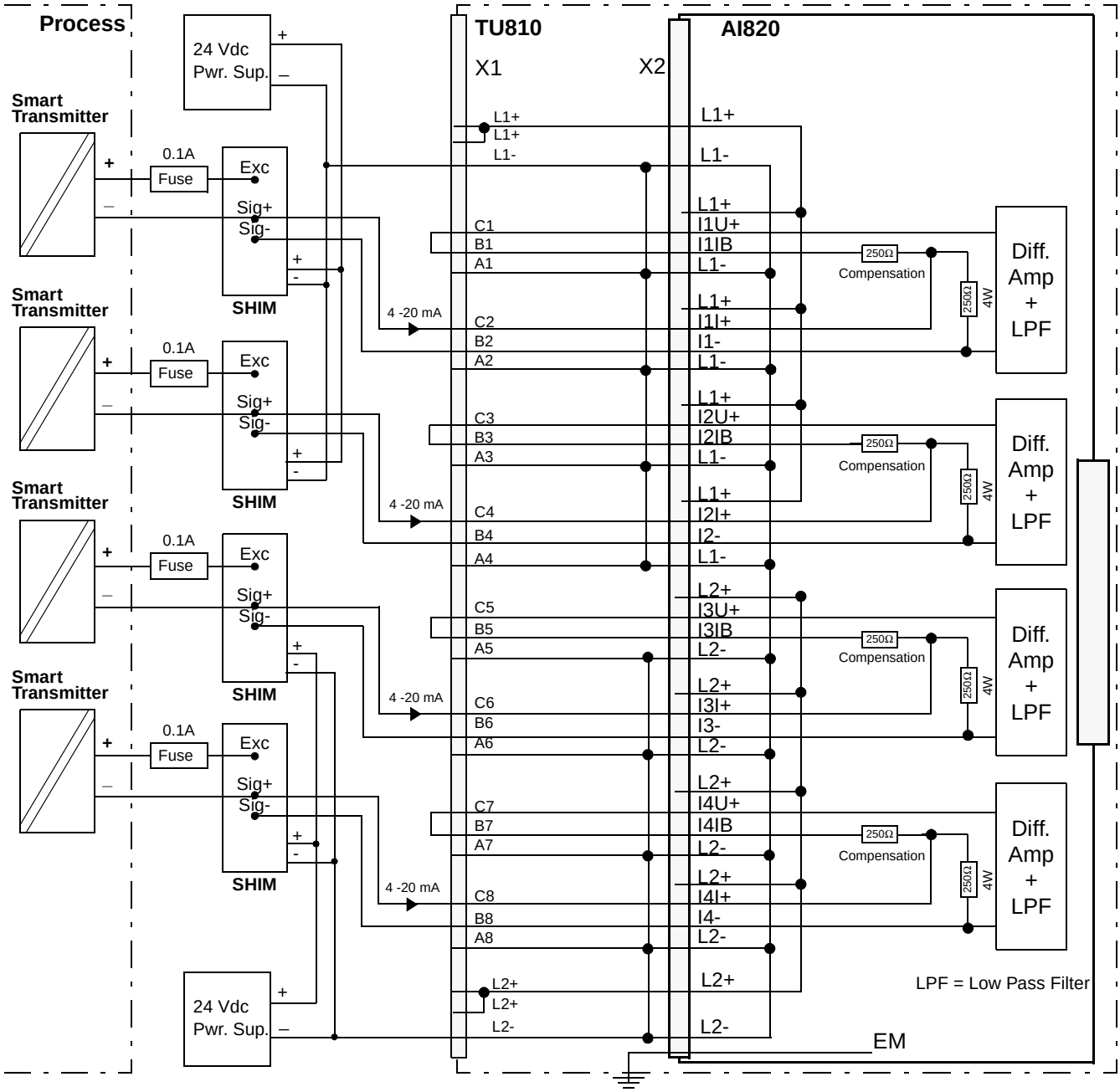

Figure 2-25. AI820 with Compact MTU (TU810) Process Connections

External fuses to each smart transmitter must be installed to protect the power to other SHIMs connected to the same power supply.

TRIO Blocks

Analog signals brought into an Advant Controller employing Taylor Remote I/O (TRIO) use either 6230B Analog Input/Output Blocks, 6231B Current Source Analog Input/Output Blocks or 6235B Current Source Analog Input Blocks. The 6230B and 6231B TRIO Blocks have terminations for four analog inputs and the 6235B TRIO Block has terminations for six analog inputs. The analog information for up to 30 TRIO blocks is communicated to the Advant Controller via a TRIO Field Bus.

To communicate information from the TRIO blocks to the Advant Controller, a CI560 TRIO submodule is required for each Field Bus. The CI560 has connections on its front panel for the physical connection of the Field Bus to the Advant Controller. Please refer to the *Taylor Remote I/O (TRIO) User's Guide*, *Advant Controller 410 User's Guide* and the *Advant Controller 460 User's Guide* for more information on TRIO connections.

NOTE

- The 24V dc loop power supply isolation of the 6231B or 6235B Current Source Analog Block is lost because the COM input is common to all the SHIM Signal- inputs.
- Configurations using 6231B or 6235B Current Source Analog Blocks require an additional 150 ohm 1% 5W resistor for each smart devices connected to the block. The resistor should be installed between its SHIM Signal+ and TRIO block IN contacts.
- To tune a smart device from the field, you can attach a hand-held monitor to its smart transmitter loop using grapper hooks across the corresponding IN and JMP terminals of the 6230B Analog Input/Output Block or IN and COM terminals of the 6231B or 6235B Current Source Analog Block the transmitter is attached to. Any tuning changes you make to the smart device using the hand-held monitor are not logged by the Advant OCS.

Figure 2-26 show the typical smart device connections for communication of both analog and digital signals to TRIO. Figure 2-28 shows the wiring for a 6231B Current Source Analog

Input/Output Block or a 6235B Current Source Analog Input Block, and Figure 2-27 shows the wiring for a 6230B Analog Input/Output Block.

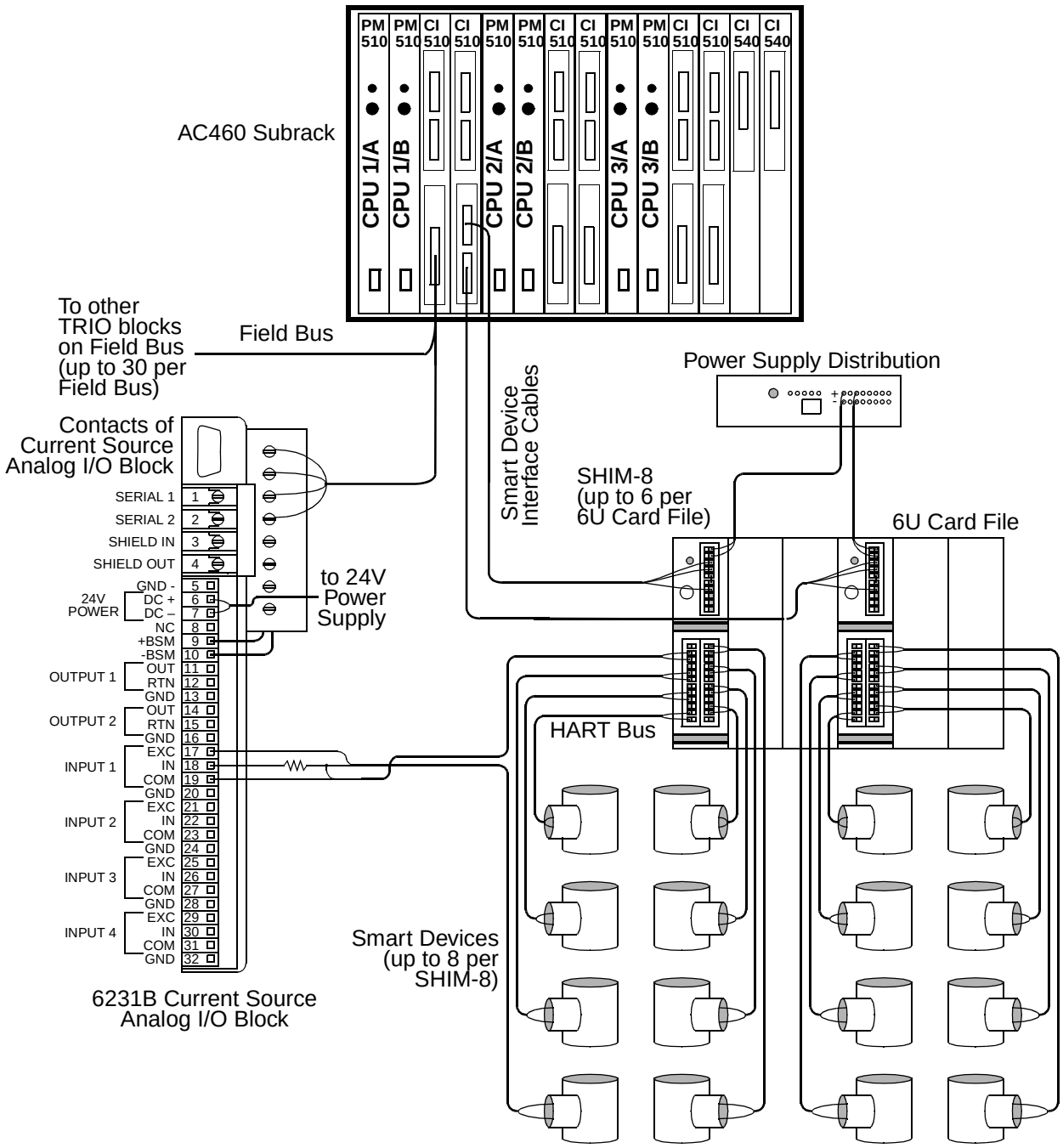

Figure 2-26. Typical Smart Device Connections to TRIO

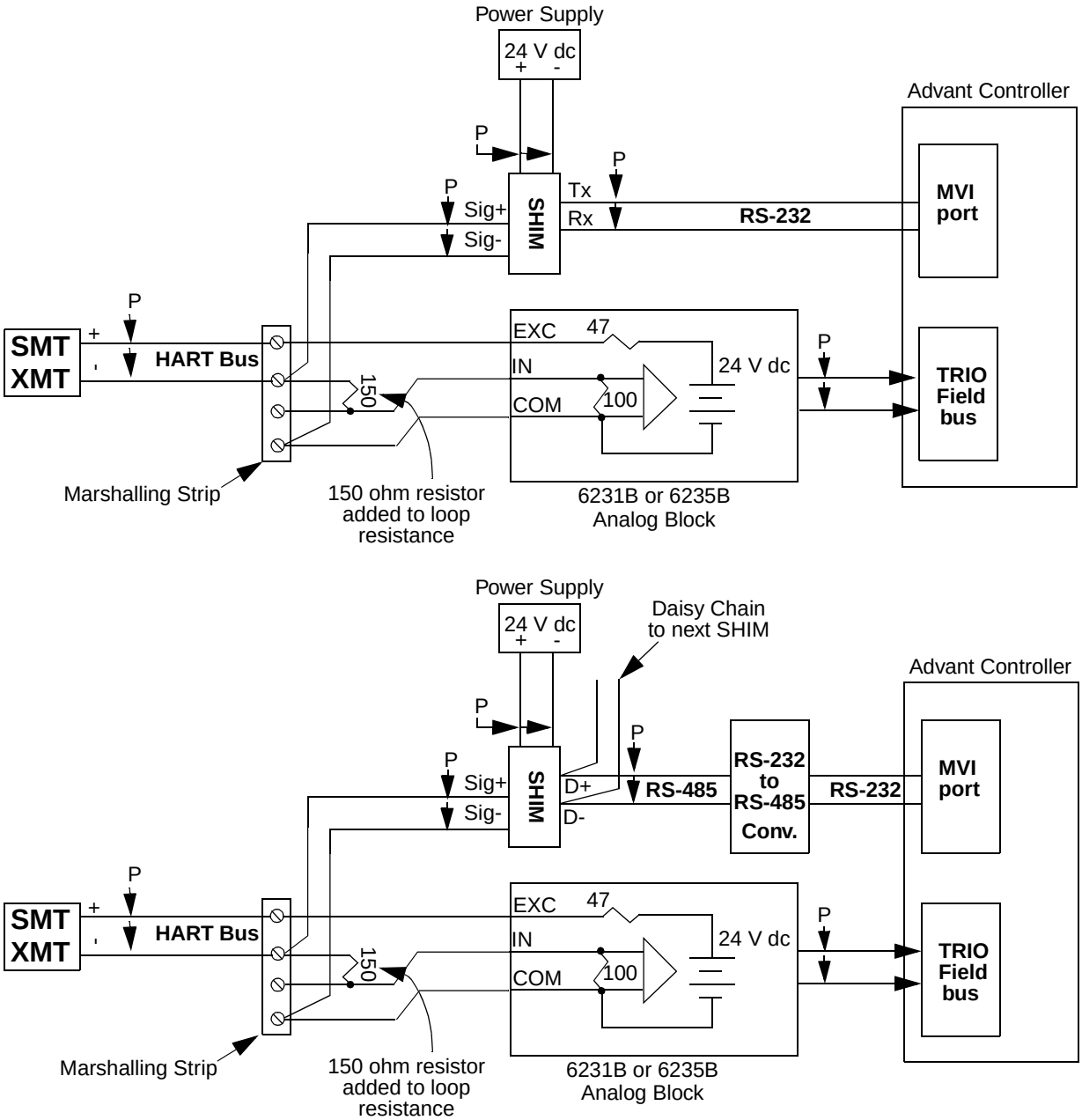

Figure 2-27. Smart Device Wired to a TRIO 6231B or 6235B Analog Block

The field wiring for the 6231B or 6235B Current Source Analog Blocks require an additional 150 ohm 1% 5W resistor for each smart device connected to the block. The resistor should be installed between its SHIM Signal+ and TRIO block IN contacts.

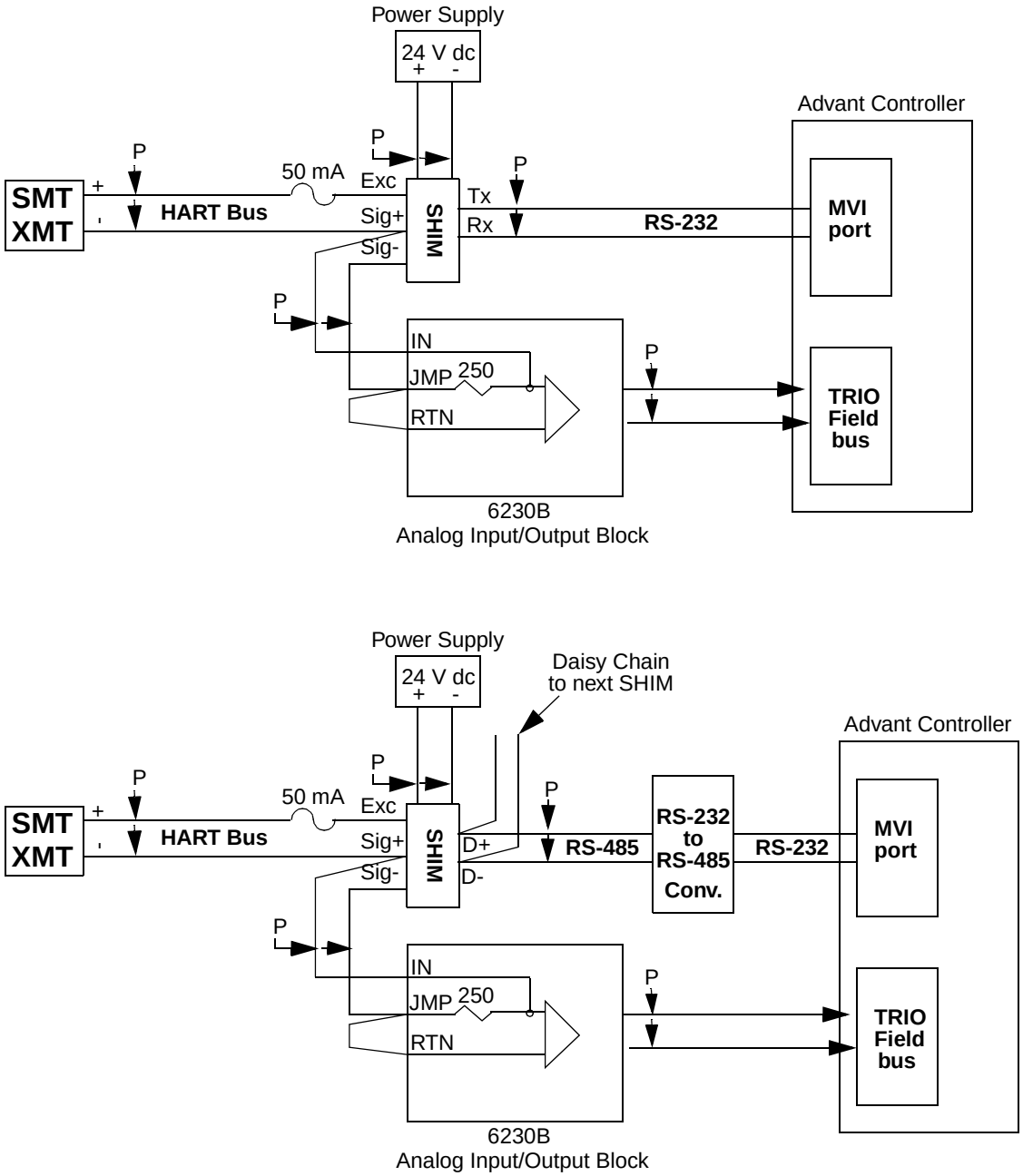

Figure 2-28. Smart Device Wired to a TRIO 6230B Analog Input/Output Block

The SHIM powers the smart device in Figure 2-28, therefore, an external 50 mA fuse is required between the smart device TX+ and SHIM Excitation connection. This is done to prevent a blown Excitation fuse from taking down all smart transmitter loops powered by the SHIM.

2.3.1.8 Power Considerations

The common mode voltage between the SHIM, termination panels, and their power supply cannot exceed 0V dc.

2.3.1.9 Special Wiring Considerations

There are several types of intrinsic safety barriers configurations used when operating in environments that require intrinsic safety. Use either shunt-diode safety barriers or isolating repeaters.

NOTE

You can use most intrinsic safety barriers, provided 2-way digital communication between smart transmitters and the SHIM is not impeded.

2.4 Smart Device Data Storage Considerations

This section discusses how the data from smart devices is stored, and suggests a technique you can use in programming or configuring smart devices and in configuring the Smart Device Interface. The technique is intended to optimize the utilization of memory and avoid problems that can make a smart device layout inefficient. In addition, the assigning of CCF channel numbers in the Smart Device Interface is discussed to show the effect of the technique on their usage. A channel should not be used by more than one device.

As Figure 2-29 shows, there is one analog channel table in a AC 410 or AC 460 subsystem to support analog inputs from the smart devices.

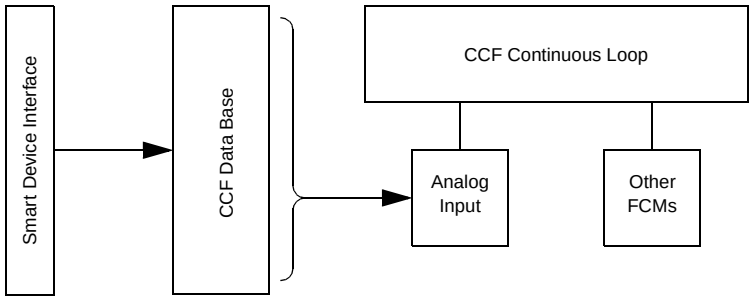

Figure 2-29. Smart Device/CCF Loop Communication Scheme

An analog input FCM of a continuous loop can acquire the value of a variable in the analog channel table. It is accessed as an input by one FCM.

NOTE

An AC 410 or AC 460 subsystem has one analog channel table to support smart device inputs. If one smart device stores its four inputs in analog channels 1 through 4, another smart device should not store its input data in these analog channels.

2.4.1 Setup Information for Smart Devices

Smart devices are connected to the Advant Controller. Section 2.2, Setup, has information about the types of serial connections supported.

Configuration of the MVI ports requires entries to the fields in the edit window of the MVIBOARD templet and MVI_PORT templet. The templets are described in Section 3.3.4.1, MVIBOARD and Section 3.3.4.2, MVI_PORT.

2.4.2 Configuration Entries for Smart Devices

Entries required for configuring communications with the smart devices are via the PLC Templet, PLC_PORT Templet PLC_DEF Templet and SMARTNET Templet using the AdvaBuild Structure Builder. The methods of using these displays and a description of their entry fields are provided in Section 3.3.5.1, PLC Object, Section 3.3.5.2, PLC_PORT Object, Section 3.3.5.3, PLC_DEF Object and Section 3.3.5.4, SMARTNET Object.

2.4.3 Techniques of Mapping Smart Device Variables to Advant OCS

The ModbusB functions supported by the interface for smart devices are listed in Table 2-14. You should check it prior to configuring your smart devices.

Table 2-14. Modbus Function Codes — Smart Devices

Function Code	Description
Modbus Function Code 1	Read output coil
Modbus Function Code 2	Read input coil
Modbus Function Code 3	Read output register
Modbus Function Code 4	Read input register
Modbus Function Code 5	Write single output coil
Modbus Function Code 6	Write single output register
Modbus Function Code 15	Write multiple output coil
Modbus Function Code 16	Write multiple output register

Commands for the PLC Command Templet

The following commands are valid entries for smart devices on the PLC Command Templet. Their use is described in the remainder of this section. General information for making entries to the PLC_COMmand Templet is provided in Section 3.3.5.4, SMARTNET Object.

DFOA-C Define Output Only Area - Coils

DFOA-R Define Output Only Area - Register

RIC Read Input Coil

ROC	Read Output Coil
RIR	Read Input Register
ROR	Read Output Register
SCAC	Scan Complete Acknowledge to a Coil
SCAR	Scan Complete Acknowledge to a Register

Performing Reads and Writes for smart devices

Smart devices use the following definitions:

Coil	is a discrete device. Discrete outputs are called output coils and inputs are called input coils, input statuses, or discrete inputs.
Register	is an analog device. Analog inputs are called input registers and outputs are called output or holding registers.

ModbusB memory locations are listed in Table 2-15.

Table 2-15. ModbusB Memory Locations

ModbusB Data Type	MOD 300 Range in PLC Command Templet
Output Coil	1-9999
Input Coil	10001-19999
Input Register	30001-39999
Output Register	40001-49999

The interface software automatically performs Modbus read/write commands to the appropriate SHIM memory locations. Based on Smart transmitter information in the configuration templets.

Reading Coils and Registers

Four commands are used to read the memory locations:

RIC	Read Input Coil
ROC	Read Output Coil
RIR	Read Input Register
ROR	Read Output Register

Scan Acknowledge Commands

The scan acknowledge commands, SCAC and SCAR, are executed only after a read is completed and provide a means to inform the smart device that all its data has been read by writing a "1" value to either the coil or register specified. When a smart device detects the scan

acknowledgment, it can overwrite the data image table it maintains with fresh data. This technique is especially useful for reading digital data rapidly.

Writing to Coils or Registers

There are four methods to write to coils and registers:

- ROC, Read Output Coil
- ROR, Read Output Register
- DFOA-C, Define Output Only Area - Coil
- DFOA-R, Define Output Only Area - Register

Chapter 3 Configuration

3.1 Design Considerations

This chapter describes the AdvaBuild structure builder templets required to support the Advant Smart Device (HART) Interface. General information for using the structure builder is provided in the *AdvaBuild Basic Functions User's Guide*.

3.1.1 Advant Smart Device Interface Configuration Procedures

The basic steps required for configuring a Smart Device (HART) Interface are:

1. Plan the Smart Device Interface configuration carefully, referring to the smart device manufacturer's instructions as well as to this document and the related documents it references.
2. Configure the smart devices that are to exchange analog and digital information with the Advant Smart Device (HART) Interface.

   NOTE

   Initial configuration of smart devices must be done prior to installing them in the field. This is achieved using an external device such as a PC-based configuration package (not supplied with the interface) or a hand-held monitor.

   During initial configuration, you must specify the unique tag name and transmitter polling address for each smart device connected to a SHIM. The tag name is used when establishing initial communication with a smart device to obtain its unique identifier. The transmitter polling address you specify for each smart device should be 0 (zero), allowing for the communication of both analog and digital signals by the smart device. If you specify an address other than 0, the analog signal is not generated with the digital signal.

3. Use the structure builder to complete the configuration of the system. The configuration of the smart device part of the data base is described in Section 3.3, Configuration Building. Remember to include the CCF loops that interact with the smart devices.

3.2 Capacity and Performance

The Advant OCS system can do 10 read/write commands or 250 words (2 byte words) per second to a ModbusB device.

3.3 Configuration Building

Smart devices are connected to the Advant OCS System via an Advant Controller 460 and/or an Advant Controller 410.

3.3.1 Advant Controller 460 and Related Objects

An Advant Controller 460 is represented in the Advant OCS database by an AC460 object. This object is a child of the AREA object and represents a subsystem in the area. Each CPU in the Advant Controller 460 must be represented by an AC460MOD object. The children of the AC460MOD object determine the functionality of that CPU (for example, CCF, S100, TRIO, MVI, PLC and so on). This database hierarchy is shown in Figure 3-1 and described in Table 3-1.

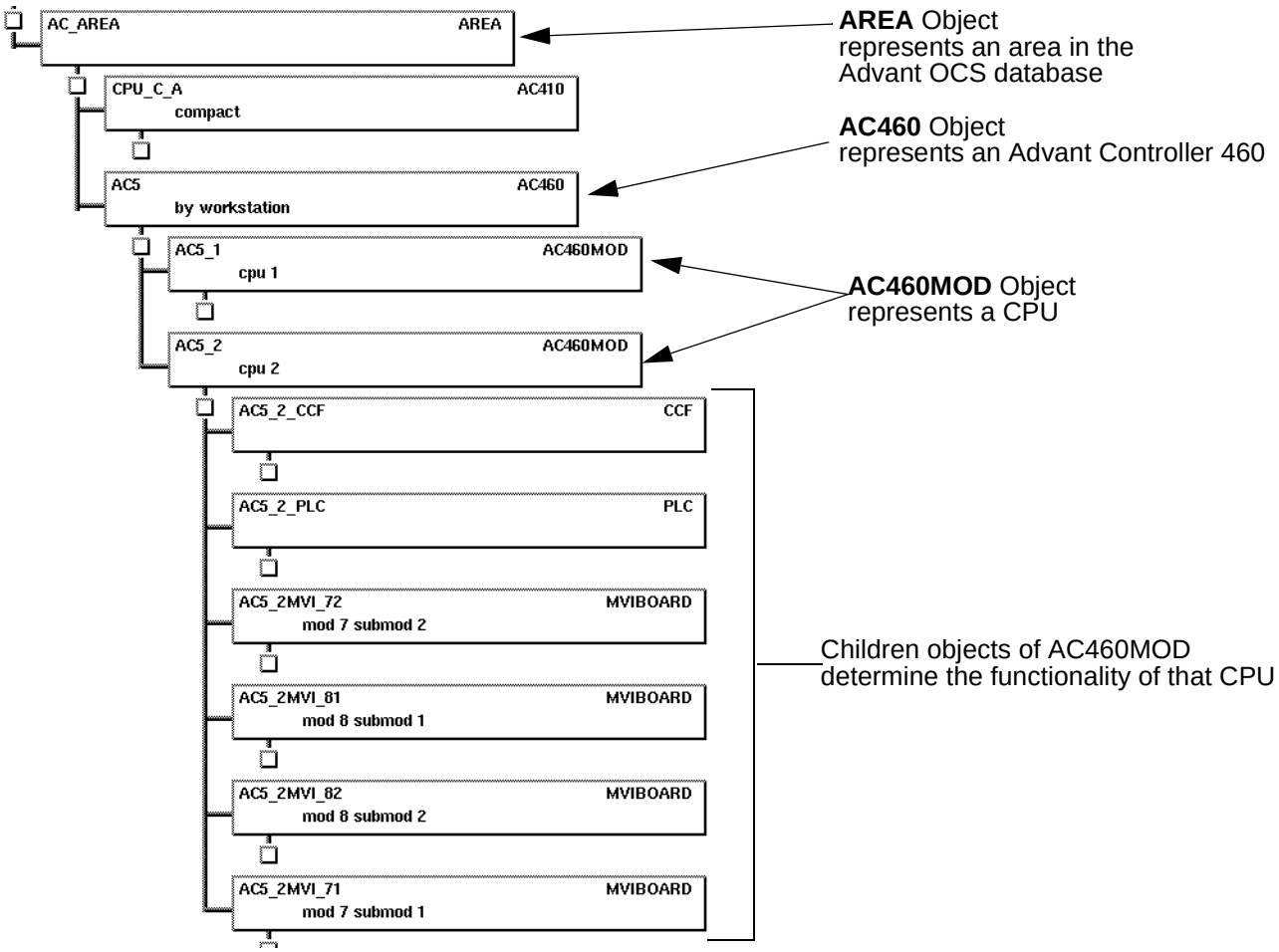

Figure 3-1. AC460 Hierarchy Related to AREA Object

The AC460 database object is inserted into the Advant OCS database hierarchy and its object attributes are defined via the AdvaBuild Structure Builder and Template Builder respectively (as described in the *AdvaBuild Basic Functions User's Guide)*.

The Controller (AC460) and related objects are listed in Table 3-1.

Table 3-1. Advant Controller 460 Related Objects

OBJECT TYPE	PURPOSE	REFERENCE
AC460	Child of AREA object. Establishes one Advant Controller subsystem under a configuration area.	*Advant Controller 460 User's Guide*
AC460MOD	Child of AC460 object. One required per CPU (non-redundant module or redundant pair), up to 3 per subsystem. Establishes basic operating parameters for each CPU group.	*Advant Controller 460 User's Guide*
CCF	Child of AC460MOD object. Required for control modules that support Configurable Control Functions (CCF). Establishes basic CCF operating parameters for the module, particularly the base processing rate upon which individual loop processing rates are based.	B130 - Configurable Control Functions.
AC_TRIO	Child of AC460MOD object. Required for control modules that support Taylor Remote I/O.	*Advant Controller 460 User's Guide*
S100_IO	Child of AC460MOD object. Required for control modules that support S100 I/O.	*Advant Controller 460 User's Guide*
MVIBOARD	Child of AC460MOD object. Required for control modules that support serial I/O devices such as a PLC.	This instruction book, Section 3.3.4.1, MVIBOARD.
MVI_PORT	Child of the MVIBOARD object. Required to define the operating parameters of each port on the MVI module.	This instruction book, Section 3.3.4.2, MVI_PORT.
PLC	Child of AC460MOD object. Required for control modules that support PLC and smart devices.	This instruction book, Section 3.3.5.1, PLC Object
PLC_PORT	Child of PLC object. Required to define the MVI port that will be used.	This instruction book, Section 3.3.5.2, PLC_PORT Object
PLC_DEF	Child of the PLC_PORT object. Required to describe the SHIM addressing of and related items for each device.	This instruction book, Section 3.3.5.3, PLC_DEF Object
SMARTNET	Child of the PLC_DEF object. Required to define the correlation between the smart device connected to the SHIM and the CCF channel numbers.	This instruction book, Section 3.3.5.4, SMARTNET Object
LL_DEV	Child of AC460MOD object. Required for control modules that run Taylor Ladder Logic software.	B170 - Taylor Ladder Logic.
TCL_RUN	Child of AC460MOD object. Required for control modules that run Taylor Control Language (TCL).	B160 - Taylor Control Language

Table 3-1. Advant Controller 460 Related Objects (Continued)

OBJECT TYPE	PURPOSE	REFERENCE
TCL_MBOX	Child of TCL_RUN object. One required for each mailbox being established for a control module.	B160 - Taylor Control Language
UNITMAST	Child of AC460MOD object. Required for control modules that run Taylor Control Language (TCL).	B160 - Taylor Control Language

3.3.2 Advant Controller 410 and Related Objects

An Advant Controller 410 is represented in the Advant OCS database by an AC410 object. This object is a child of the AREA object and represents a subsystem in the area. The PM150 Control Module in the Advant Controller 410 must be represented by an AC410 object. The children of the AC410 object determine the functionality of the CPU (for example, CCF, S100, TRIO, MVI, PLC and so on). This database hierarchy is shown in Figure 3-2 and described in Table 3-2.

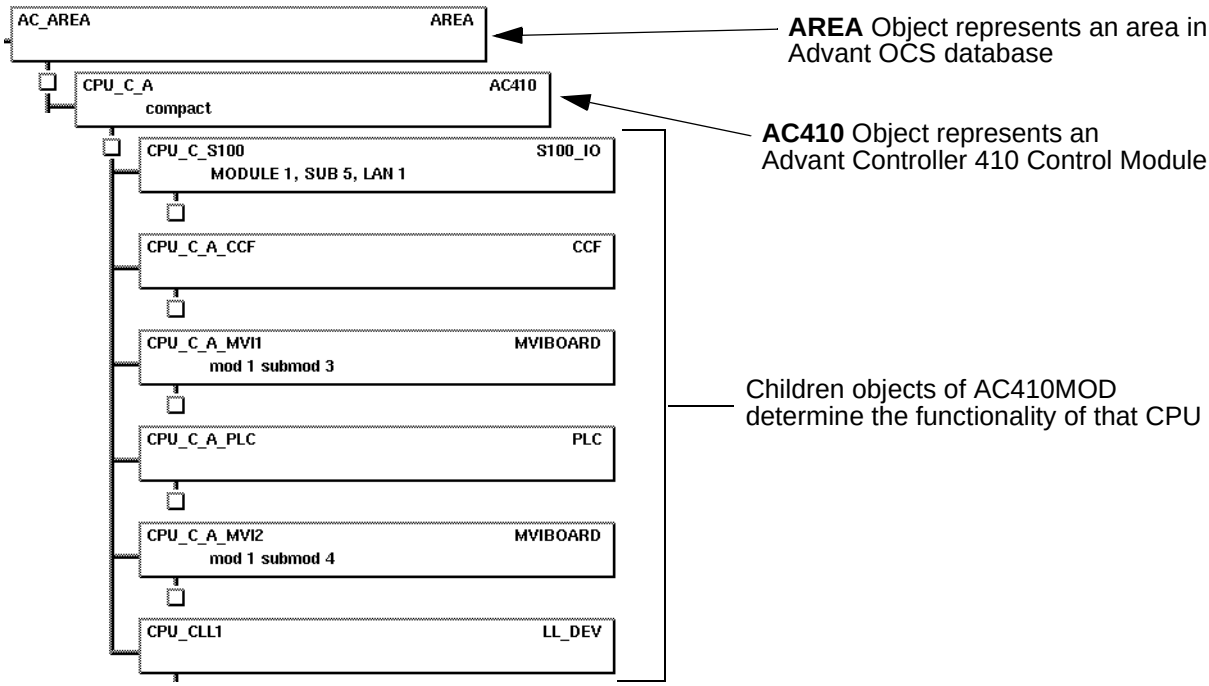

Figure 3-2. AC410 Hierarchy Related to AREA Object

The AC410 database object is inserted into the Advant OCS database hierarchy and its object attributes are defined via the AdvaBuild Structure Builder and Template Builder respectively (as described in the *AdvaBuild Basic Functions User's Guide*).

The Controller (AC410) and related objects are listed in Table 3-2.

Table 3-2. Advant Controller 410 Related Objects

OBJECT TYPE	PURPOSE	REFERENCE
AC410	Child of AREA object. Establishes one Advant Controller subsystem under a configuration area.	*Advant Controller 410 User's Guide*
CCF	Child of AC410 object. Required for control modules that support Configurable Control Functions (CCF). Establishes basic CCF operating parameters for the module, particularly the base processing rate upon which individual loop processing rates are based.	B130 - Configurable Control Functions.
AC_TRIO	Child of AC410 object. Required for control modules that support Taylor Remote I/O.	*Advant Controller 410 User's Guide*
S100_IO	Child of AC410 object. Required for control modules that support S100 I/O.	*Advant Controller 410 User's Guide*
MVIBOARD	Child of AC410 object. Required for control modules that support serial I/O devices such as a PLC.	This instruction book, Section 3.3.4.1, MVIBOARD.
MVI_PORT	Child of the MVIBOARD object. Required to define the operating parameters of each port on the MVI module.	This instruction book, Section 3.3.4.2, MVI_PORT.
PLC	Child of AC410 object. Required for control modules that support PLC devices.	This instruction book, Section 3.3.5.1, PLC Object
PLC_PORT	Child of PLC object. Required to define the MVI port that will be used.	This instruction book, Section 3.3.5.2, PLC_PORT Object
PLC_DEF	Child of the PLC_PORT object. Required to describe the SHIM addressing of and related items for each device.	This instruction book, Section 3.3.5.3, PLC_DEF Object
SMARTNET	Child of the PLC_DEF object. Required to define the correlation between the smart device connected to the SHIM and the CCF channel numbers.	This instruction book, Section 3.3.5.4, SMARTNET Object
LL_DEV	Child of AC410 object. Required for control modules that run Taylor Ladder Logic software.	B170 - Taylor Ladder Logic.
TCL_RUN	Child of AC410 object. Required for control modules that run Taylor Control Language (TCL).	B160 - Taylor Control Language
TCL_MBOX	Child of TCL_RUN object. One required for each mailbox being established for a control module.	B160 - Taylor Control Language
UNITMAST	Child of AC410 object. Required for control modules that run Taylor Control Language (TCL).	B160 - Taylor Control Language

3.3.3 Advant Controller Objects

3.3.3.1 AC460

This object represents an Advant Controller 460 subsystem in the Advant OCS database, Figure 3-3. This object has the following configurable attributes:

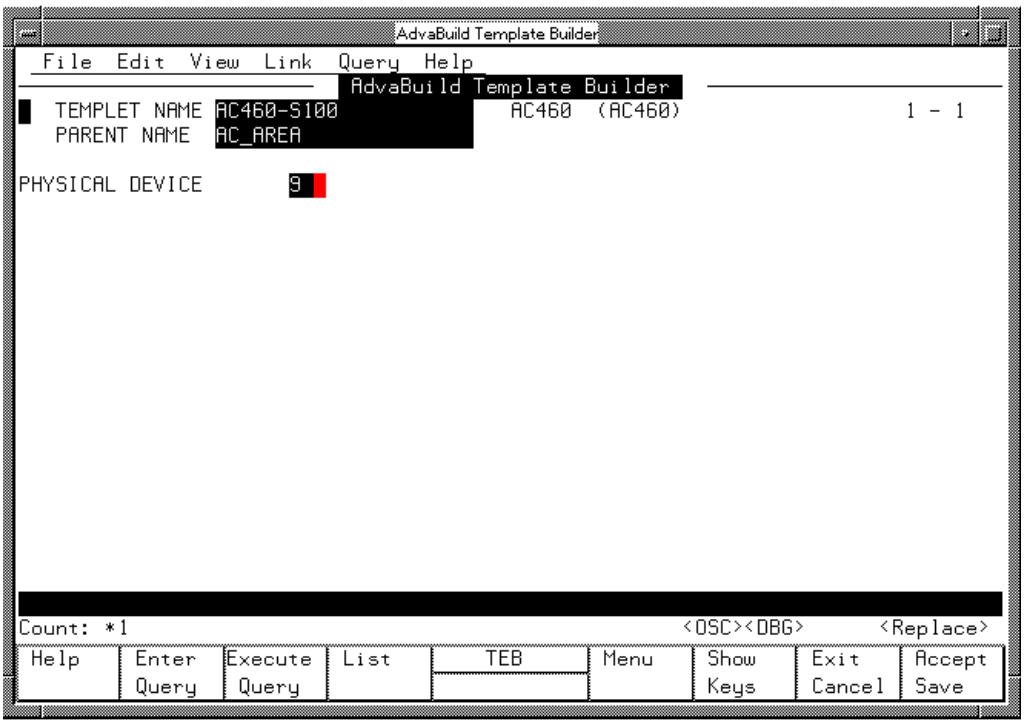

Figure 3-3. AC460 Object

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the AC460 templet a name that contains up to 21 characters. The name must be unique system wide.

PHYSICAL DEVICE

This is the DCN node address. This must be the *decimal equivalent* of the hex address set on the SC540 Carrier Module in the subsystem. Be sure to enter the decimal equivalent value in the Physical Device address field. It can be at any physical address from 2 to 255 decimal.

3.3.3.2 AC460MOD

Each PM510 CPU group (non-redundant module or redundant pair) in the AC460 subsystem must be represented by an AC460MOD object, Figure 3-4. This object has the following configurable attributes:

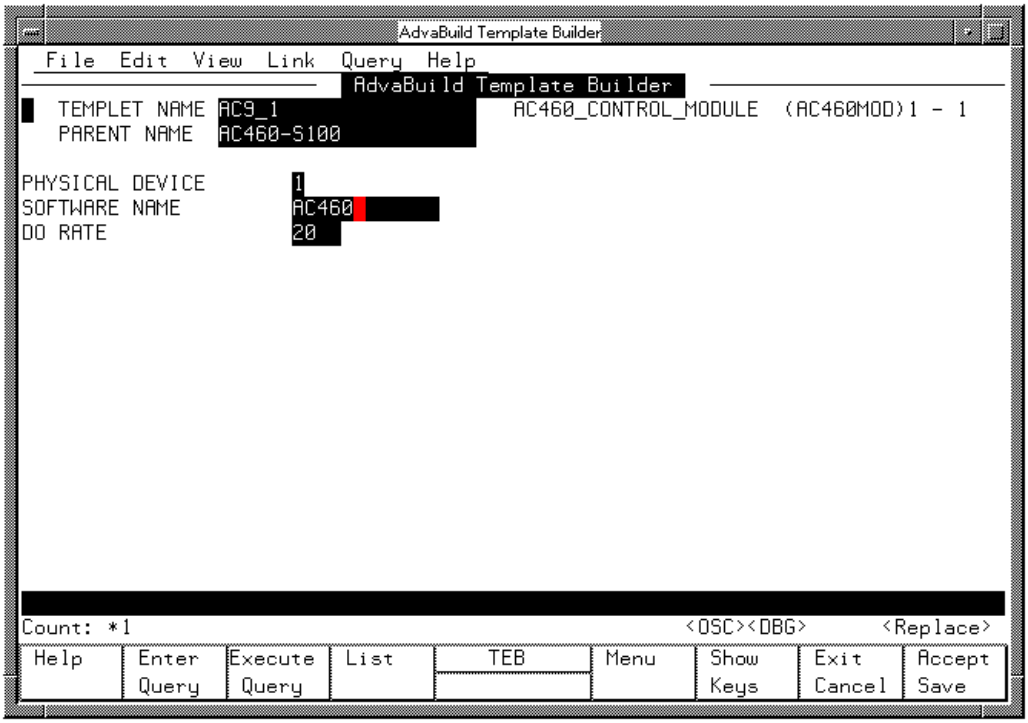

Figure 3-4. AC460MOD Object

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the AC460MOD templet a name that contains up to 21 characters. The name must be unique system wide.

PHYSICAL DEVICE

This field specifies the location of the CPU group (non-redundant PM510K01 or redundant PM510K02) in the subrack.

Valid entries are: **1**, **2**, or **3**.
Entry **1** is for the CPU(s) located in slots 1 and 2.
Entry **2** is for the CPU(s) located in slots 5 and 6.
Entry **3** is for the CPU(s) located in slots 9 and 10.

NOTE

The redundant CPU pair is automatically configured by the hardware for proper operation.

SOFTWARE NAME Field

This field specifies the software downloaded to the controller at start-up.

Valid entries are: **AC460.**

Default is: **AC460**

DO RATE Field

The DO RATE field specifies the minimum resolution of any pulse output for the controller. For pulse train outputs, the pulse width and pulse interval as specified through the PO CHANNEL NUMBER edit window of the Controller I/O Templet must be multiples of the DO Rate. For pulse duration outputs, the duration value calculated by the Pulse Duration FCM is rounded to the next lower multiple of the DO Rate.

Valid entry is:

a number of milliseconds as either **20**, **40**, **100**, **200**, or **1000**

Default is: **20**

NOTE

Digital inputs are scanned at one half the DO RATE. This is important because using the DO RATE default value of 20 ms when no pulse outputs are present will lead to a high CPU load. The scan rate for smart devices is not affected by the DO RATE field.

3.3.3.3 AC410

The Control Module in the Advant Controller 410 subsystem must be represented by a AC410 object, Figure 3-4. This object has the following configurable attributes:

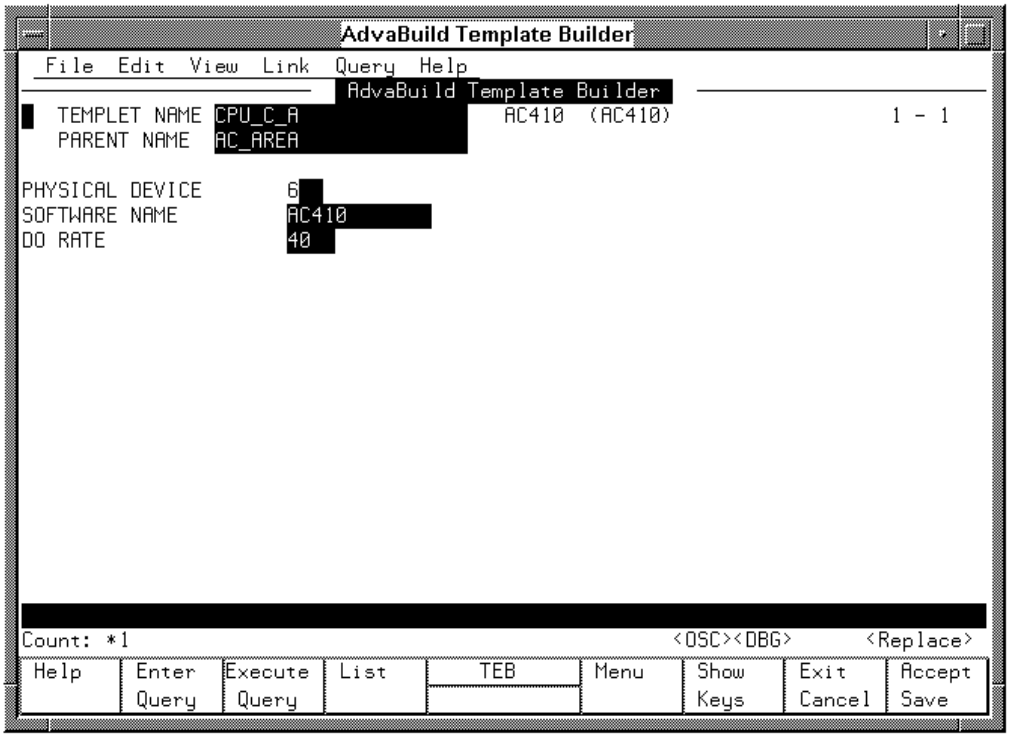

Figure 3-5. AC410 Object

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the AC410 templet a name that contains up to 21 characters. The name must be unique system wide.

PHYSICAL DEVICE

This is the DCN node address. This must be the *decimal equivalent* of the hex address set on the CS512 DCN Interface submodule. Be sure to enter the decimal equivalent value in the field. It can be at any physical address from 2 to 255 decimal.

SOFTWARE NAME Field

This field specifies the software downloaded to the controller at start-up.

Valid entries are: **AC410**

Default is: **AC410**

DO RATE Field

The DO RATE field specifies the minimum resolution of any pulse output for the controller. For pulse train outputs, the pulse width and pulse interval as specified through the PO CHANNEL NUMBER edit window of the Controller I/O Templet must be multiples of the DO Rate. For pulse duration outputs, the duration value calculated by the Pulse Duration FCM is rounded to the next lower multiple of the DO Rate.

Valid entry is:

a number of milliseconds as either **20**, **40**, **100**, **200**, or **1000**

Default is: **20**

NOTE

Digital inputs are scanned at one half the DO RATE. This is important because using the DO RATE default value of 20 ms when no pulse outputs are present will lead to a high CPU load. The scan rate for smart devices is not affected by the DO RATE field.

3.3.4 MVI Module and Port Planning

The serial port parameters are specified on MVIBOARD and MVI_PORT objects. Each SHIM connected to smart device requires a serial channel for which you define parameters via these objects.

An Advant Controller 410 is equipped with either one or two MVI modules depending upon the number of serial ports required. A MVIBOARD Templet must be completed for each MVI module and an MVI_PORT Templet for each port of the MVI module.

An Advant Controller 460 can have up to 4 MVI modules (8 serial ports). One MVIBOARD Templet is required for each MVI module and an MVI_PORT Templet for each port of the MVI module.

3.3.4.1 MVIBOARD

Four is the maximum number of MVIBOARD objects you can configure for any given controller CPU of an AC460 and 2 for an AC410. The purpose of this object is to associate an MVI submodule with a carrier module and/or its submodule position. The example defines an MVI submodule for this AC 460 CPU to be associated with module location 4, and submodule 1 with a ModbusB protocol. Figure 3-6 is an example of the MVIBOARD object templet view. This object has the following configurable attributes:

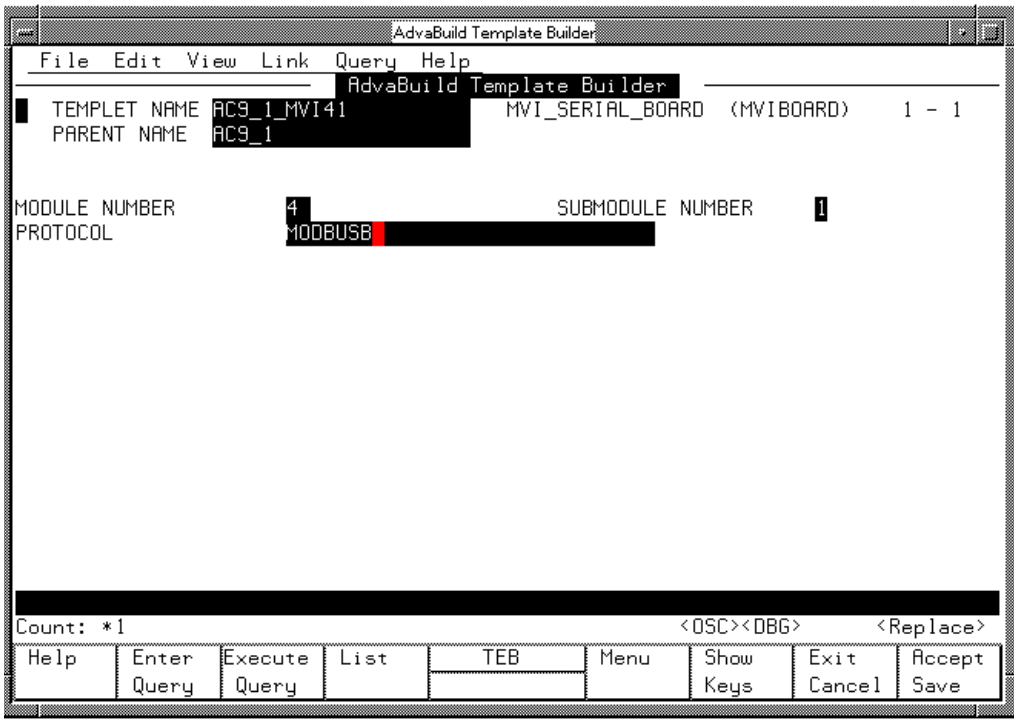

Figure 3-6. MVIBOARD Templet

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the MVIBOARD templet a name that contains up to 21 characters. The name must be unique system wide.

MODULE NUMBER

AC410:
Enter the slot number (1) for the position of the PM150 on the backplane.

AC460:
Enter the slot number (3, 4, 7, 8, 11, or 12) for the position of the SC510 Carrier Module in the backplane.

The Default value is 3.

SUBMODULE NUMBER

AC410:
Enter the number 3 (left) or 4 (right) corresponding to where the MVI is installed in the PM150 Control Module.

AC460:
Enter a number from 1(top) to 2 (bottom) corresponding to where the MVI module is installed in the SC510 Carrier Module.

The Default value is 1.

PROTOCOL

Enter the protocol type depending on the MVI submodule installed and protocol required.

The possible entries are:

GENERIC for CI532V05 MVI
TERMCHAR for CI532V05 MVI
ALLENBRADLEY for CI532V04 MVI
MODBUSB for CI532V02 MVI **<- used for SHIMs**
MODBUSPLUSfor CI537V01 MVI

NOTE

Each type of MVI submodule has a special PROM set to run the various protocols. The protocol configured above must be set to match the submodule's characteristics.

Associated with each MVIBOARD object is the MVI_PORT object that defines the characteristics of each port on the MVI module. See Section 3.3.4.2, MVI_PORT for information on how to define each port.

3.3.4.2 MVI_PORT

Two is the maximum number of MVI_PORT objects you can configure for any CI532 MVI submodule. The AC410 can have up to 4 MVI_PORTs and each AC460MOD (PM510) can have up to 8 MVI_PORTs defined. This object is a child of the MVIBOARD object and is used to define the operating parameters of a port on a MVI submodule. The example defines port number 5 of the third MVI submodule. Figure 3-7 is an example of the MVI_PORT object templet view. This object has the following configurable attributes:

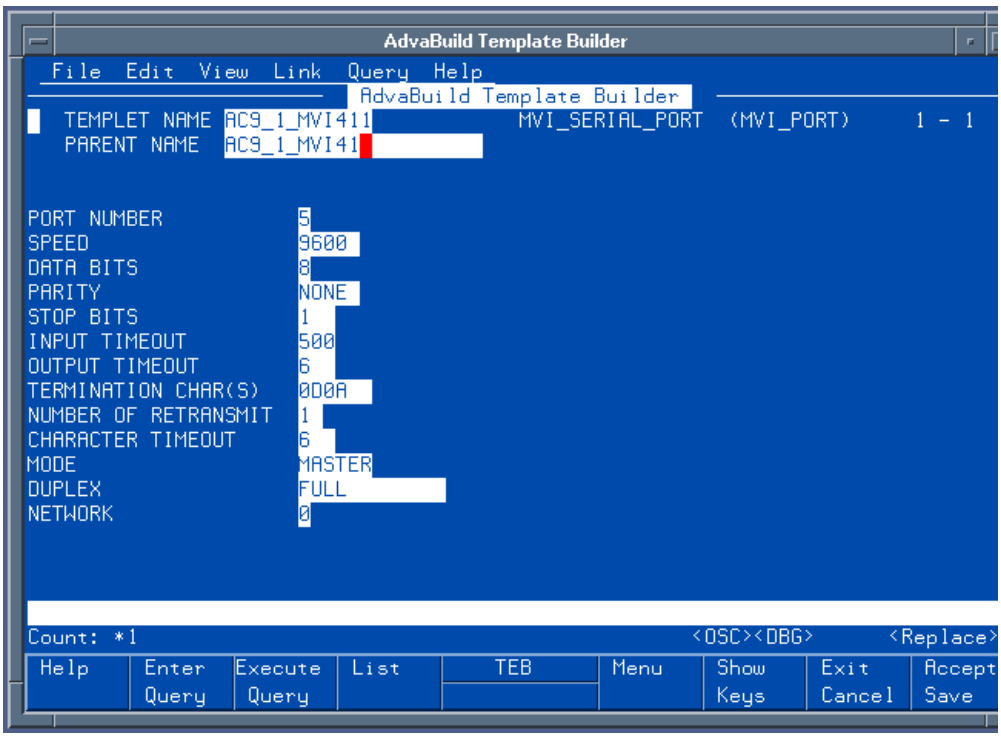

Figure 3-7. MVI_PORT Templet

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the MVI_PORT templet a name that contains up to 21 characters. The name must be unique system wide. This name is used by the PLC_PORT object (Section 3.3.5.2, PLC_PORT Object) to define which port is to be used.

PORT NUMBER

Enter the port number on the MVI module that is to be defined.

AC410:
MVI module in Submodule 3 - upper connector is port 1 and lower connector is port 2.
MVI module in Submodule 4 - upper connector is port 3 and lower connector is port 4.

AC460: (Per PM510 CPU location)
Carrier Module 1 - Submodule 1 - upper connector is port 1 and lower connector is port 2.
Carrier Module 1 - Submodule 2 - upper connector is port 3 and lower connector is port 4.
Carrier Module 2 - Submodule 1 - upper connector is port 5 and lower connector is port 6.
Carrier Module 2 - Submodule 2 - upper connector is port 7 and lower connector is port 8.

The Default value is 1.

SPEED

Use the **List** function key (**<F4>**) to list the possible values of the BAUD rate for the serial I/O device the port will be communicating with. Use the **Up Arrow** or **Down Arrow** keys to highlight the speed wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is 9600.

The possible values are:
150
300
600
1200
2400
4800
9600 **<- used for SHIMs**
19200
38400

DATA BITS

Use the **List** function key (**<F4>**) to list the possible values for the DATA BITS size required by the serial I/O device. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is 8.

The possible values are:
5
6
7
8 **<- used for SHIMs**

PARITY

Use the **List** function key (**<F4>**) to list the possible values for the PARITY data required by the serial I/O device. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is NONE.

The possible values are:
NONE **<- used for SHIMs**
ODD
EVEN
SPACE
MARK

STOP BITS

Use the **List** function key (**<F4>**) to list the possible values for the number of STOP BITS required by the serial I/O device. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is 1.

The possible values are:
.5
1 **<- used for SHIMs**
1.5
2

INPUT TIMEOUT

Enter the INPUT TIMEOUT value in milliseconds or seconds (see note) that the MVI will wait for the completion of an input operation before an error code is generated.

The initial default value is 0.

The possible values are:

0 to 999

Enter 500 for SHIMs.

NOTE

Units are in milliseconds for ModbusB.

OUTPUT TIMEOUT

Enter the OUTPUT TIMEOUT value in milliseconds or seconds (see note) that the MVI will wait for the completion of an output operation before an error code is generated.

The initial default value is 0.

The possible values are:

0 to 999

Enter 6 for SHIMs.

NOTE

Units are in milliseconds for ModbusB.

TERMINATION CHAR(S)

Enter the termination character(s) that is used with TERMCHAR protocol types. It is used to specify, in ASCII(hex) code, up to three termination characters (field length = 6).

The initial default value is 0D0A (carriage return, line feed).

No entry needed for SHIMs.

NUMBER OF RETRANSMIT

Enter the number of re-transmissions of data after an error.

The initial default value is 3.

The possible values are:

0 to 10

Enter 1 for SHIMs.

CHARACTER TIMEOUT

Enter the CHARACTER TIMEOUT value in milliseconds. GENERIC and TERMCHAR must be set to 0. The CHARACTER TIMEOUT for Allen Bradley is 6.

The initial default value is 0.

The possible values are:

0 to 255

Enter 6 for SHIMs.

MODE

Use the **List** function key (<**F4**>) to list the possible MODEs that the MVI will operate in with the serial I/O device. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (<**F8**>) to enter the value in the field.

The initial default value is MASTER.

The possible values are:

MASTER <**- used for SHIMs**
SLAVE

DUPLEX

Use the **List** function key (**<F4>**) to list the possible method of communications that will be used with the serial I/O device. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is HALF

The possible values are:

HALF
FULL
HALF-NO-DCD

for SHIMs use:

FULL for RS-232 to SHIM
HALF for RS-485 to SHIM

NETWORK

Enter the requirement for a network definition.

The initial default value is 0 (no).

The possible values are:

0 (no) **<- used for SHIMs**
1 (yes)

3.3.5 Configuration of Smart Device (PLC) Parameters

The parameters of each smart device that will be connected to each Advant Controller are defined by four objects: PLC, PLC_PORT, PLC_DEF and SMARTNET.

3.3.5.1 PLC Object

The PLC object is a child of the AC410 object or of an AC460MOD object. Only one (1) PLC object can be defined per parent object. The PLC defines the global variables which the PLC package needs to run. The example of the PLC object templet view is shown in Figure 3-8. This object has the following configurable attributes:

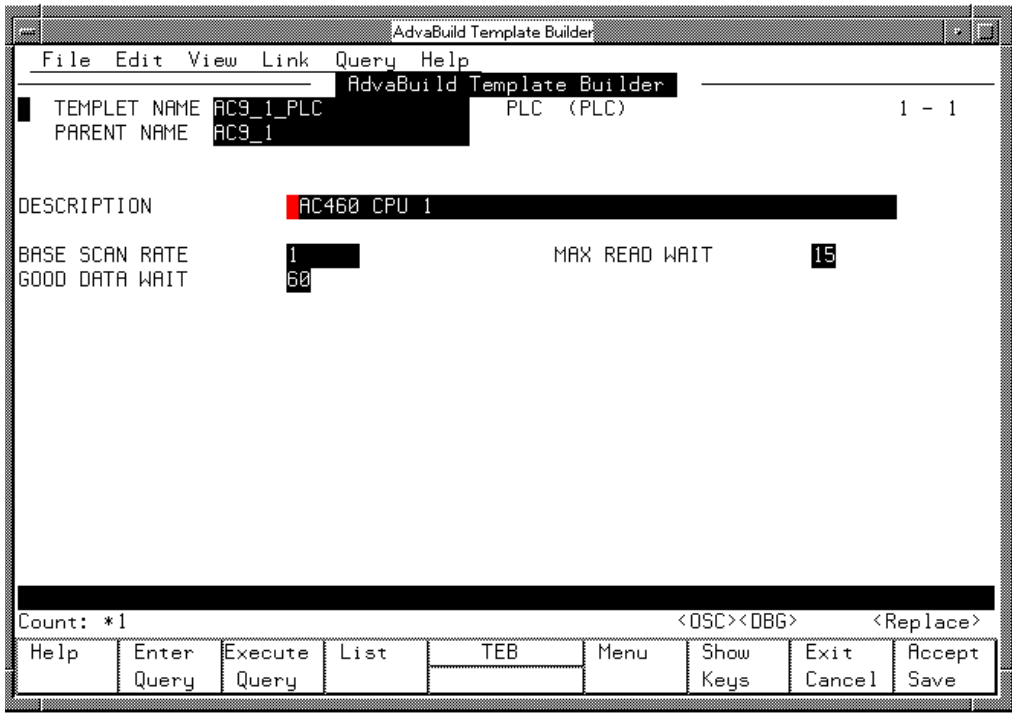

Figure 3-8. PLC Templet

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the PLC templet a name that contains up to 21 characters. The name must be unique system wide.

DESCRIPTION

Enter a descriptive name for this Smart Device (PLC) operation. The description can be up to 50 characters.

BASE SCAN RATE

Enter the base scan rate of the PLC scanner (in seconds). This is the rate at which the scanner function processes requests. It is the fastest that any command can be processed.

The range for this entry is 0.2 (200 ms) to 600.0 seconds.

Default = 1 second.

Enter 1 for SHIMs.

GOOD DATA WAIT

Enter the maximum time to wait at start-up for a full set of commands to complete. When this time has expired, CCF is allowed to continue processing.

Range for this entry is 5 to 60 seconds.

Default = 15.

Enter 60 for SHIMs.

MAX READ WAIT

Enter the maximum base rate periods to wait before forcing a set of reads. This is needed because data writes have precedent over reads.

Range for this entry is 5 to 60 scans.

Default = 15.

EXAMPLE: (MAX READ WAIT) x (BASE SCAN RATE) = Total Read Wait Time in seconds
15 x 10 = 150 seconds

Enter 15 for SHIMs.

3.3.5.2 PLC_PORT Object

The PLC_PORT object is a child of the PLC object. One PLC_PORT object is needed for each MVI port with SHIMs attached. The PLC_PORT defines which MVI port to use as defined in an MVI_PORT object. The example of the PLC_PORT object templet view is shown in Figure 3-8. This object has the following configurable attributes:

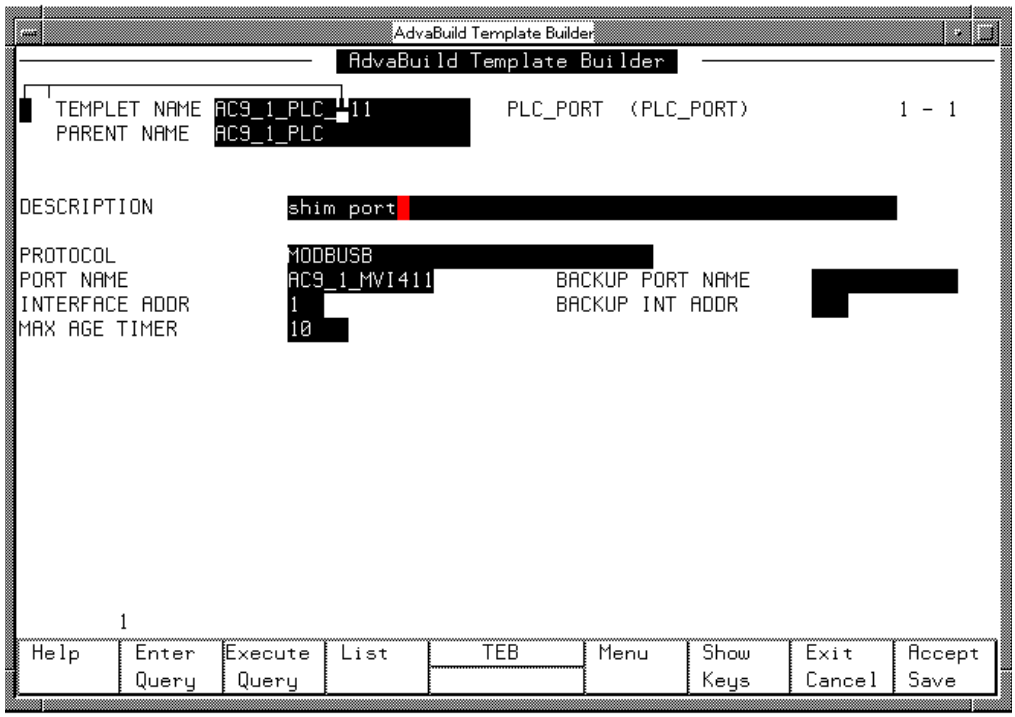

Figure 3-9. PLC_PORT Templet

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the PLC_PORT templet a name that contains up to 21 characters. The name must be unique system wide.

DESCRIPTION

Enter a descriptive name for this PLC_PORT as it is being used. The description can be up to 50 characters.

PROTOCOL

Enter the protocol type depending on the MVI submodule installed and protocol required.

The possible entries are:

GENERIC for CI532V05 MVI
TERMCHAR for CI532V05 MVI
ALLENBRADLEY for CI532V04 MVI
MODBUSB for CI532V02 MVI <- **used for SHIMs**

NOTE

Each type of MVI submodule has a special PROM set to run the various protocols. The protocol configured above must be set to match the submodule's characteristics.

PORT NAME

Enter the Templet Name for the MVI_PORT object that this PLC_PORT will be connected to. Refer to Figure 3-7 for an example of the templet name of an MVI_PORT.

NOTE

Do not configure multiple PLC_PORT objects associated with the same MVI_PORT name.

BACKUP PORT NAME

Enter the Templet Name for the MVI_PORT object that is the back-up port for redundant communications that this PLC_PORT will be connected to. If this field is left blank, then there is no back-up port defined. Refer to Figure 3-7 for an example of the templet name of an MVI_PORT.

Leave blank for SHIMs.

INTERFACE ADDR

This is used for data highways, and is the address of the interface between the serial port and the data highway. Smart devices do not have interface address modules defined, so this value should be left at the default value (1).

Default = 1.

Enter 1 for SHIMs.

BACKUP INT ADDR

This is the back-up interface board address of the smart device that is used to communicate with the system. Some smart devices do not need back-up interface address modules defined, so this value should be zero(0).

Default = 0.

Leave blank for SHIMs.

MAX AGE TIMER

This value defines the maximum time to wait for a response to a request to a smart device.

Range is from 1 to 32000 seconds.

Default = 10.

Enter 10 for SHIMs.

3.3.5.3 PLC_DEF Object

The PLC_DEF object is a child of the PLC_PORT object. One PLC_DEF object is needed for each SHIM connected to this PLC_PORT. A maximum of 31 templets for PLC TYPE = SHIM. The PLC_DEF defines the addressing of each SHIM and other interface related items. The example of the PLC_DEF object templet view is shown in Figure 3-10. This object has the following configurable attributes:

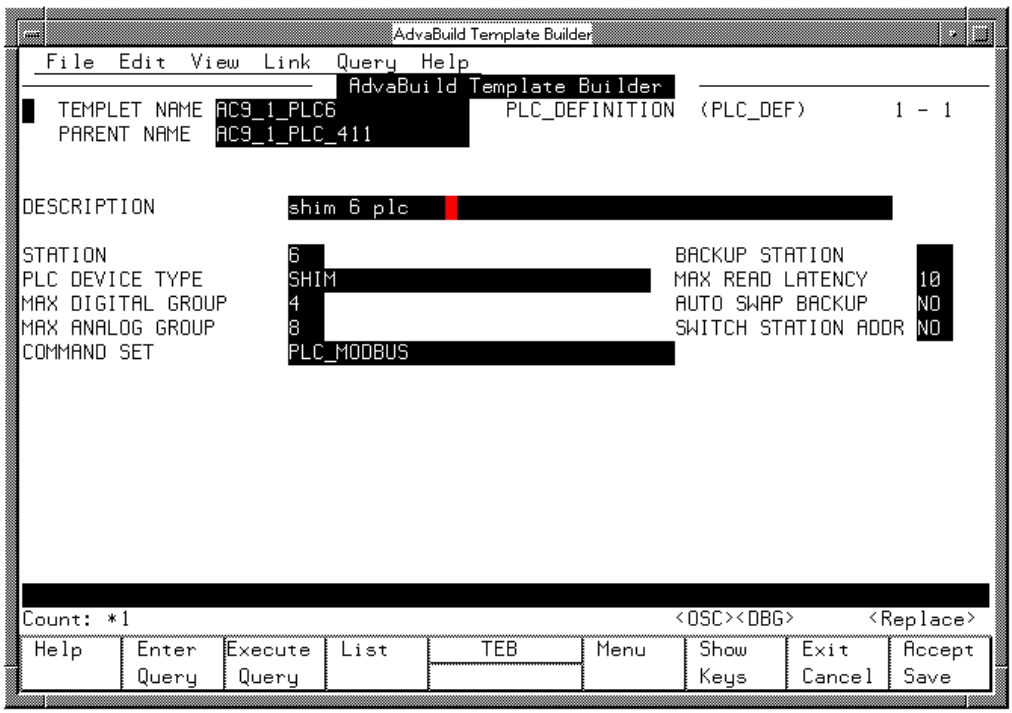

Figure 3-10. PLC_DEF Templet

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the PLC_DEF templet a name that contains up to 21 characters. The name must be unique system wide.

DESCRIPTION

Enter a descriptive name for this PLC_DEF as it is being used. The description can be up to 50 characters.

STATION

ModbusB slave address set via the DIP switch labeled S1 on the SHIM. Valid entries are 1 through 31 regardless of whether the SHIM is connected to an MVI serial I/O port via RS-232 directly or through the converter for RS-485.

The field range is from 1 to 255 (in decimal).

Default = 0.

BACKUP STATION

This is the back-up station address. An address of zero(0) means that there is no redundancy.

The field range is from 1 to 255 (in decimal).

Default = 0.

Leave blank for SHIMs.

PLC DEVICE TYPE

This is the definition of the smart device manufacturer and model that is attached to the port. The acceptable smart device types are defined in the PLCTYPES reference templet that is defined as part of the PLC_DIR for the data base to use. Please see Section A.1.4, PLCTYPES Initial Data Base for more information on the reference templet.

Acceptable PLC DEVICE TYPES are:

- SHIM <- **used for SHIMs**.
- AB_SLC504
- AB_PLC2
- AB_PLC3
- AB_PLC5
- MOD_984
- GENERIC (for non-specified devices)

MAX READ LATENCY

This is the maximum time allowed between read commands. This is how long the scanner will wait before forcing a set of reads to occur. When the time expires a read is placed at the beginning of the output queue.

The fields range is 5 to 500 seconds

Default = 10.

Enter 10 for SHIMs.

MAX DIGITAL GROUP

This is the maximum window size (words) for attempting to create a digital group output command to the smart device.

Use the **List** function key (**<F4>**) to list the possible digital group sizes. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is 8.

The possible values are:

4 **<- used for SHIMs**
8
16
32
64
96
128

NOTE

The number entered in this field is the number of *words*, not *channels*.

AUTO SWAP BACKUP

This defines if there is an automatic swap to the back-up port when both ports are DOWN and the "back-up port" comes up first.

Use the **List** function key (**<F4>**) to list the possible action of AUTO SWAP BACKUP. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is NO.

The possible values are:

NO **<- used for SHIMs**
YES

MAX ANALOG GROUP

This is the maximum window size for attempting to create an analog group output command to the smart device.

Use the **List** function key (**<F4>**) to list the possible analog sizes. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is 16.

The possible values are:

4
8 **<- used for SHIMs**
16
32
64
96
128

SWITCH STATION ADDR

This will define whether there will be a switch of station address when there is a swap of serial ports.

Use the **List** function key (**<F4>**) to list the possible action of SWITCH STATION. Use the **Up Arrow** or **Down Arrow** keys to highlight the value wanted, then press the **Accept** function key (**<F8>**) to enter the value in the field.

The initial default value is NO.

The possible values are:

NO **<- used for SHIMs**
YES

COMMAND SET

This templet names the commands for the type of smart device attached to the port. The acceptable smart device types are defined in the PLC_CMDS reference templets that are defined as part of the PLC_DIR of the Advant OCS data base. Please see Section A.1.1, PLC_AB Initial Data Base, Section A.1.2, PLC_MODBUS Initial Data Base, and Section A.1.3, PLC_COMMON Initial Data Base for more information on the reference templets.

Acceptable PLC_CMDS are:

- PLC_AB
- PLC_MODBUS **<- used for SHIMs**
- PLC_COMMON

3.3.5.4 SMARTNET Object

The SMARTNET object is a child of the PLC_DEF object. SMARTNET objects define the smart devices connected to each SHIM. The SMARTNET also defines the correlation between the smart devices and the CCF channel numbers. One SMARTNET templet allowed per PLC_DEF object of PLC TYPE = SHIM. The example of the SMARTNET object templet view is shown in Figure 3-11. This object has the following configurable attributes:

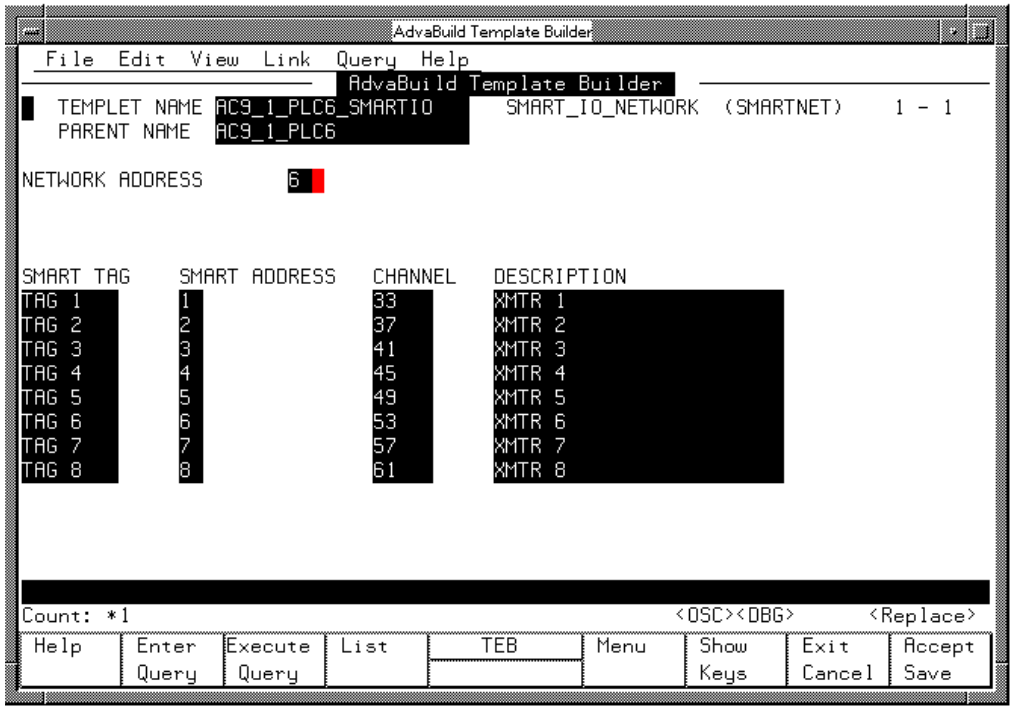

Figure 3-11. PLC_COM Templet

TEMPLET NAME

The templet name is required on all templets in the Template Builder. Give the SMARTNET templet a name that contains up to 21 characters. The name must be unique system wide.

NETWORK ADDRESS

ModbusB slave address set via the DIP switch labeled S1 on the SHIM. Valid entries are 1 through 31 regardless of whether the SHIM is connected to an MVI serial I/O port via RS-232 directly or through the converter for RS-485. The network address must match the STATION address value entered in the PLC_DEF templet.

NOTE

You can connect only one SHIM directly with RS-232 to the serial I/O port. You can connect up to 31 SHIMs to a serial I/O port of a via a RS-485 bus, however, each SHIM on the RS-485 bus must have a unique address.

SMART TAG

Name for the smart device of up to eight alphanumeric characters as specified during its initial configuration.

NOTE

The SMART TAG value must be unique system wide.

SMART ADDRESS

Channel on the SHIM where the smart device is connected. You can connect up to four smart devices to a SHIM-4, therefore, valid transmitter addresses for devices connected to a SHIM-4 are 1 through 4. You can connect up to eight smart devices to a SHIM-8, therefore, valid transmitter addresses for devices connected to a SHIM-8 are 1 through 8.

NOTE

The entry for the SMART ADDRESS is **not** the polling address configured within the transmitter. It is the physical channel where the transmitter is wired to the SHIM.

CHANNEL

This is the starting CCF channel number that the smart device's data relates to. CCF channel number in the range of 1 to 32767 where the first of the smart device's **four (4)** input values (primary value, secondary value, tertiary value and fourth value) should be placed.

An Advant Controller may contains multiple types of I/O in which case the different I/O use different tables. For example, one analog input FCM can access information from an analog I/O input channel 1 without interfering with an FCM in another loop that accesses smart device analog channel 1.

Field range is from 1 to 32767.

Default = 0

NOTE

There is only one analog smart device table in a subsystem to support smart devices. For example, if a smart device uses channel 33 for an input, channel 33 cannot be used by any other smart device as input.

DESCRIPTION

General descriptor for the smart device of up to 24 alphanumeric characters.

You must complete a line of entries in the window for each smart device connected to the SHIM. For example, if six smart devices are connected to the SHIM, complete six lines in the edit window.

3.4 Application Building

3.4.1 CCF Templet

Entries to the CCF (Configurable Control Functions) Templet are described in the *Configurable Control Functions (CCF)* instruction book. Figure 3-12 represents a sample CCF Templet.

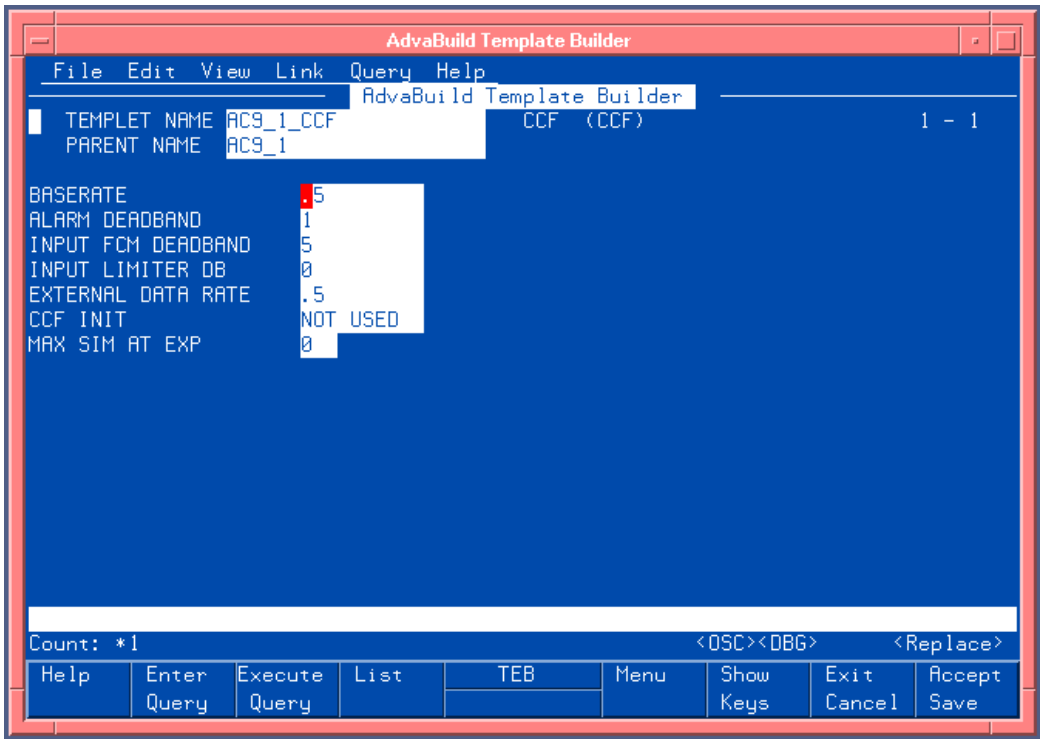

Figure 3-12. CCF Templet

3.4.2 Configuration of Advant OCS Loops that Support Smart Devices

Each smart device that sends variables to the Advant OCS System must be supported by one or more Advant OCS CCF loops that reside within the Advant Controller. These loops serve as a mechanism by which the information from words (registers) and bits (coils) of the smart device can be read from the Advant OCS data base and manipulated as required. When planning these loops, you should consult the CCF channel number and smart device data mapping information accumulated during planning of the smart device configuration.

These loops require completion of the following templets:

Loop	Templet
Continuous	Loop Definition and FCM as required by the loop
FCMs of Continuous	For CCF loop inputs and outputs, analog input, analog output, digital input, digital output, and pulse duration output FCMs can be used by continuous loops that support smart devices. Pulse input and pulse train output FCMs must not be used. The templets are described in the *Configurable Control Functions (CCF)* instruction book. For the Analog Input FCM Templet, where there are special considerations for smart device support, some parameters of the templet are described in this section.

3.4.3 Loop Definition and FCM Templets

Basic information about the fields on the Loop Definition Templet and FCM Templets is provided in the *Configurable Control Functions (CCF)* instruction book. The following description provides supplemental information for fields requiring specific entries to define a loop whose input is from a smart device. Figure 3-13 contains an example of a Loop Definition Templet.

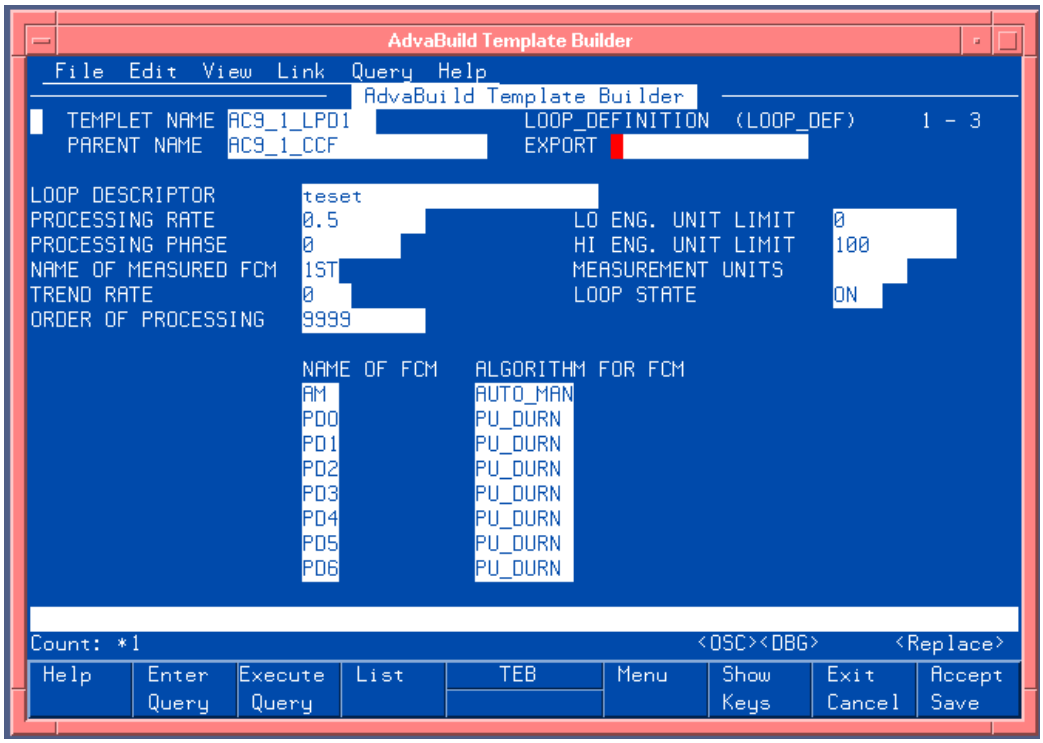

Figure 3-13. Loop Definition Templet, Page 1

Many fields on the Loop Definition Templet are concerned with trending, displaying, or defining alarms for the measured variable of the loop. It should be remembered that the loops described in this section allow a smart device variable to be used as the loop measured variable; therefore, the items being defined for the measured variable on the form are actually being defined for the smart device variable.

Make the following entries to the fields of the Loop Definition Templet:

TEMPLET NAME	Name for the templet of up to a 12 alphanumeric characters. This name becomes the tag name for the loop and must be unique system-wide
LOOP DESCRIPTOR	Enter any combination of up to 24 characters. The tag and this descriptor identify the parameters of the loop (thus the smart device variables) when displayed on the Operational Displays or when listed on the Alarm/Event Log.

PROCESSING RATE	Enter 0 (zero) for processing on demand, or enter a rate. The smart device input to the loop is analog, a processing rate must be specified. NOTE: The rate at which the SHIM scans smart device data is three times per second. If you place a hand-held monitor on-line with the smart device, the rate at which the SHIM scans smart device data drops to one time per second. The loop processing rate should not be faster than the SHIM scan rate.
PROCESSING PHASE	Leave at default value if processing rate of zero is specified.
TREND RATE	Leave at 0 (default) for no trending; or enter a number: 6, 12, 60, 120, 360, 720, 1440, or 2880. An entry must be made to this field if the measured variable is to be trended. The entry should be chosen to best suit the smart device variable that is specified as the measured variable of the loop in the NAME OF MEASURED FCM field.
ORDER OF PROCESSING	Leave at default value. This field is not applicable to this type of loop.
LO ENG UNIT LIMIT	Specify the lower boundary for trend graphs. (Value becomes default for LO LIMIT and LO LO LIMIT fields on page 2 of templet.)
HI ENG UNIT LIMIT	Specify the upper boundary for trend graphs. (Value becomes default for HI LIMIT and HI HI LIMIT fields on page 2 of templet.)
MEASUREMENT UNITS	Enter a string of up to 6 characters such as PSIG. The character string that you enter is used as a label whenever the measured variable of this loop is displayed on the operational displays. The entry for this field should be chosen to best suit the smart device variable that is specified as the measured variable of the loop in the NAME OF MEASURED FCM field.
LOOP STATE	Enter the word ON. ON should be the entry for this field.

Edit Window on Templet—The bottom of the first page of the Loop Definition Templet has an edit window where you list the names and types of child templets that are to be generated for this smart device support loop.

Make entries to the FCM list for FCMs of this loop. Typically, the loop needs FCMs that input smart device data from, and output processed data to, CCF channels in the smart device interface.

The second page of the Loop Definition Templet contains fields to define alarms for the loop. Alarms are defined for smart device support loops in the same manner as for other CCF loops. The third page of the templet can be used in the normal manner as described in the *Configurable Control Functions (CCF)* instruction book.

3.4.4 FCM Input Templet

Analog input FCMs can be used to acquire inputs from, and send outputs to, the analog data base of the subsystem. The Smart Device Interface provides the ability to use the value of a digitally-read variable as input to a control loop.

The fields on the FCM Templets are used for the most part as described in the *Configurable Control Functions (CCF)* instruction book with the exception of the following fields.

VENDOR TYPE	Enter SMART I/O.
CHANNEL NUMBER	Enter the channel number in the range of 1 to 32767. Remember there is only one analog and one digital smart device channel table in a subsystem to support smart devices. If a smart device uses channel 115 for an input, channel 115 cannot be used by any other smart device as input. A subsystem may contain multiple types of I/O in which case the different I/O use different tables. For example, one analog input FCM can access information from analog I/O input channel 1 without interfering with an FCM in another loop that accesses smart device analog channel 1.

Analog Input FCM Templet Planning

This description, which supplements general information on parameters of the analog input FCM contained in the *Configurable Control Functions (CCF)* instruction book, includes considerations for processing of the input variable from a smart device in the FCM, and conditioning of the variable in the smart device. Figure 3-14 is an example of an Analog Input Templet.

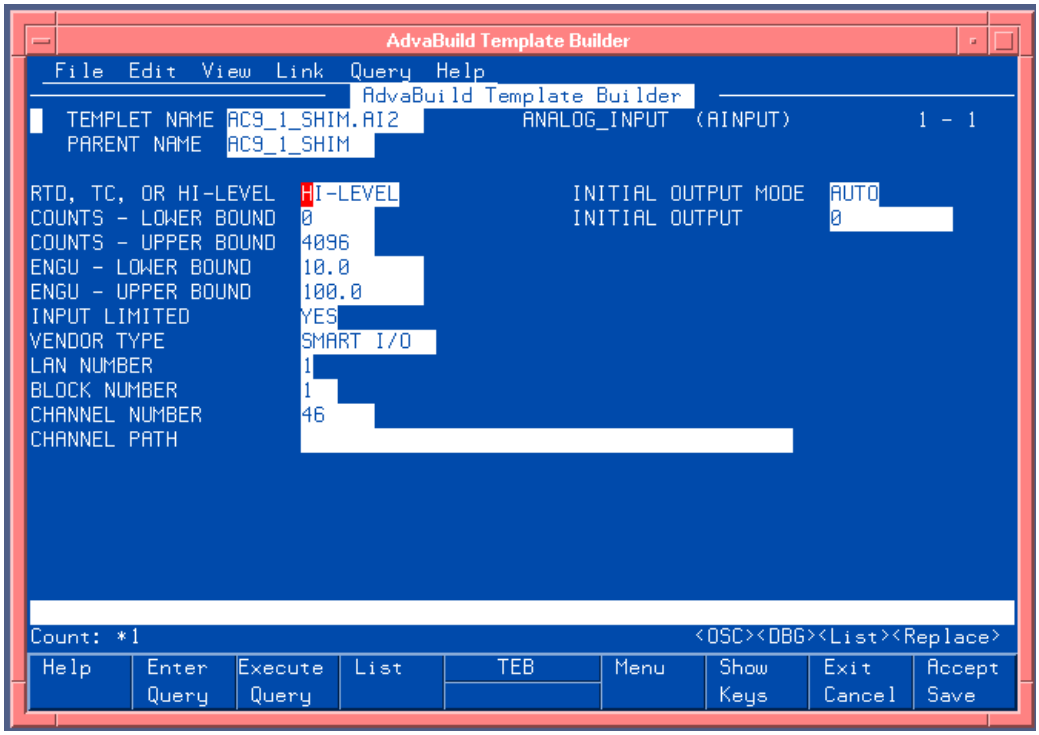

Figure 3-14. Analog Input Templet

The term *counts* is used to label the value at the analog channel table in the smart device interface of the Advant OCS System. The counts value is always in 16-bit integer format.

From the channel you specify in the CHANNEL NUMBER field of the templet, the current value (counts) is accessed and converted by CCF to a result in engineering units. This is done with a proportion defined by using your entries in the COUNTS—LOWER BOUND, COUNTS—UPPER BOUND, ENGU—LOWER BOUND, and ENGU—UPPER BOUND fields. The equation used is:

$$EU = \frac{(C - LC)(HU - LU)}{(HC - LC)} + LU$$

where:

EU	is the result of the FCM in engineering units
C	is the counts from the specified channel

LC	is the COUNTS—LOWER BOUND field entry
HU	is the ENGU—UPPER BOUND field entry
LU	is the ENGU—LOWER BOUND field entry
HC	is the COUNTS—UPPER BOUND field entry

You can assure that the result of the FCM has the number of decimal places required for the loop by taking appropriate steps when programming the smart device, and by entering appropriate values in the fields. See the following examples.

Example 1

To obtain an integer result that equals the counts:

The value of a particular integer variable, having a range of 0 to 1000, will be directly stored in and read from the smart device. This value is to be sent to channel 5 in the analog channel table of the smart device interface. To use this variable as the input for a continuous loop in the MOD System, you can proceed as follows when configuring the smart device, the smart device interface, and the analog input FCM for the related loop.

In the smart device—Store the variable in a portion of smart device memory from which it will be read when appropriate command(s) are received during scans by the interface. (See Chapter 1, Introduction.)

In the Advant OCS System—Use the SMARTNET templet, as described in Section 3.3.5.4, SMARTNET Object, to arrange for the stored value in the smart device to be sent to a channel (number 5 in this example) in the analog channel table of the interface.

For the Related Loop in the Advant OCS Data Base—Include the following entries on the Analog Input Templet to achieve an analog input FCM result equal to the original value of the variable in the smart device.

Field of Templet	Entry
CHANNEL NUMBER	5
COUNTS—LOWER BOUND	0
COUNTS—UPPER BOUND	1000
ENGU—LOWER BOUND	0
ENGU—UPPER BOUND	1000

With this configuration, when the current count is 451, the equation and result become:

$$EU = \frac{(451 - 0)(1000 - 0)}{(1000 - 0)} + 0$$

$$EU = 451$$

Example 2

To obtain a result expressed to the tenths digit:

A particular variable in the smart device can range from 0.0 to 100.0, with the value rounded to the nearest tenth; for example, 54.3 is a possible value. This value is to be conditioned, stored in, and read from the smart device. The current value read is to be sent to channel 36 in the analog channel table of the smart device interface. To use this value as the input for a continuous loop in the Advant OCS System, you can proceed as follows when configuring the smart device, and the analog input FCM for the related loop.

In the smart device—Multiply the variable by 10 and store it, as an integer variable that has a range of 0 to 1000, in a portion of smart device memory from which it will be read when appropriate command(s) are received during scans by the interface.

In the Advant OCS System—Use the SMARTNET templet, as described in Section 3.3.5.4, SMARTNET Object, to arrange for the conditioned value in the smart device to be sent to a channel (number 36 in this example) in the analog channel table of the interface.

For the Related Loop in the Advant OCS Data Base—Include the following entries to the Analog Input Templet to achieve an analog input FCM result equal to the original value of the variable in the smart device:

Field of Templet	Entry
CHANNEL NUMBER	36
COUNTS—LOWER BOUND	0
COUNTS—UPPER BOUND	1000
ENGU—LOWER BOUND	0.0
ENGU—UPPER BOUND	100.0

With this configuration, if the current value is 54.3, and the conditioned value, 543, is sent from the smart device to channel 36, the equation and result become:

$$EU = \frac{(543 - 0)(100.0 - 0.0)}{(1000 - 0)} + 0.0$$

$$EU = \frac{(543)(100.0)}{1000}$$

$$EU = 54.3$$

Chapter 4 Runtime Operation

4.1 Product Operation

The data base used by the Advant Smart Device (Hart) Interface is downloaded when the interface is powered up or reset. After an interface configuration is downloaded, periodic scanning of the smart device data commences at the configured base rate. During a scan, commands requesting data are sent to the SHIM for each smart device.

The smart devices respond to each command by sending back the requested data (via the SHIM). The smart device configuration tables then specify how the smart device data is mapped into the CCF data base, Figure 4-1. CCF accesses smart device values based on the input channel specified for each loop.

When a smart device fails to respond to a command, in its configured number of retries, an operator message is generated informing you of a smart device communications failure. The data qualities of loops associated with the smart device are set to BAD. The software continues to attempt to communicate with the smart device without generating further operator messages.

Smart devices cannot initiate communication. The Advant OCS serves as the master, and therefore only responses initiated by the Advant OCS system are accepted.

Transfer of smart device variables to the Advant OCS data base via CCF loops that receive the variables can provide the following functions within the Advant OCS System:

- Processing of smart device variables by the CCF loops that receive them, or by other CCF loops.
- Display and user-manipulation of smart device variables via the Advant OCS console. Operator changes to these variables can be transmitted back to the smart devices by the system.
- Trending of smart device variables.
- Interaction with TCL programs.
- Inclusion of smart device variables in reports produced by the Report Services software.
- Inclusion of smart device variables in displays produced by the Display Builder software.
- Storing of smart device variables by the Historical Services software.
- Generation and logging of alarms for smart device variables.

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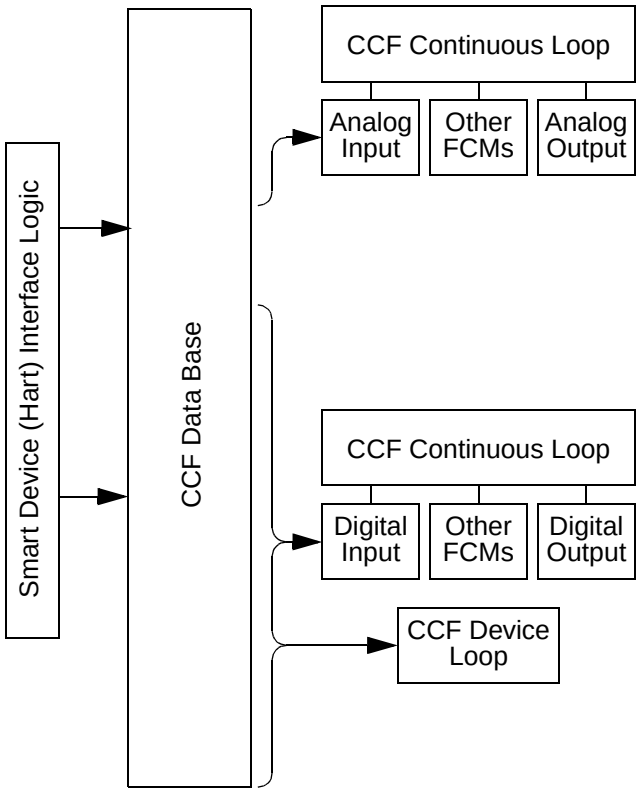


Figure 4-1. Example Smart Device/CCF Loops Communication Scheme

4.2 Operating Overview

The Advant Smart Device (Hart) Interface is the interface between smart device and CCF data points. The MOD300 database configurator defines which points should be read from the smart device, how often and where the points go in the CCF portion of the MOD300 database. CCF then generates outputs which the Advant Smart Device (Hart) Interface will convert to a command that is sent to the smart device to perform the output change.

The following diagram (Figure 4-2) briefly outlines the areas of interaction among CCF, smart device interface, and the MVI board.

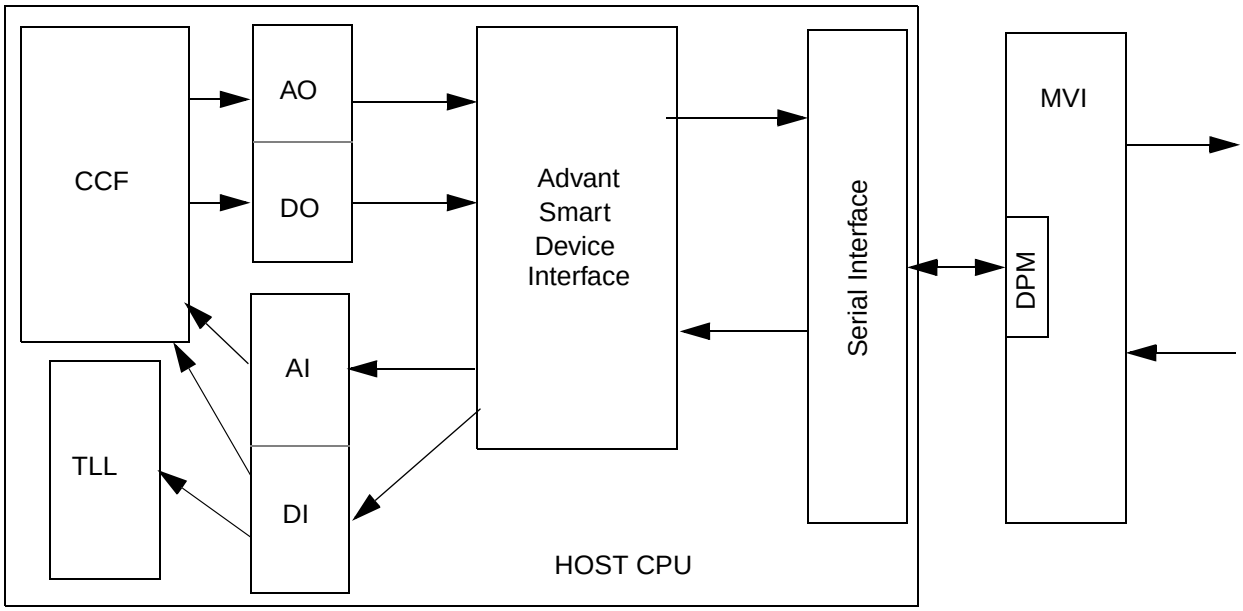


Figure 4-2. Advant Smart Device (HART) Interface Overview

4.2.1 I/O

Inputs are scanned (read) at the configured rate for each command. These values are then entered into the data base and CCF is notified of changes to digital points. Outputs are sent out (written) whenever they are received by the smart device interface. They take precedence over inputs until a configurable time (Maximum Read Wait) has elapsed when inputs shall be requested before outputs. Outputs also have the capability of being grouped together and this is done on a command basis. Grouping of outputs is the placing of all consecutive commands which are outputs and the output address falls within a defined window, maximum digital group or maximum analog group, range. Grouping is used to bring the load on the serial port down because one command takes less time to process than several individual commands.

Redundancy

No provisions are made to directly support any smart device vendors specific redundancy scheme. The redundant port can be any other port in the Advant Controller CPU. When the Advant smart device interface loses communications with the primary port and the backup port is "communicating", then a swap to the backup port is performed. Loss of communications is determined by a predefined set of error conditions. The MVI automatically performs communications testing to the configured smart devices on a given port, the application need only check the status word in the MOD300 database for the current state of the backup port.

Error Conditions

The following is a list of error conditions which will cause the Advant smart device Interface to attempt a swap to the backup communications port.

- Link down,
- Board Unavailable.

4.2.2 Start-up

During start-up from SSE the Advant Smart Device (Hart) Interface examines the MOD300 database to see if it has been defined. If it has, it creates any additional buffers it might need then starts the scanner, transmitter, receiver, momentary output, request output, backup monitor and diagnostic input tasks. It also will signal CCF that it has completed its start-up and one full scan of data. If it is not defined it will signal CCF that it is complete and does not exist.

4.2.2.1 Coordination Signals

The Serial Interface will not allow commands to be processed by it until it has sent configuration data to the MVI board. So the interface must check the MOD300 database to verify the status of the port before attempting any outputs. CCF must also wait, but it waits for the smart device interface to complete one full scan and update all the data tables before continuing processing. If the MVI can not be configured or a scan completed then CCF is signalled to continue but with bad data quality for all smart device points. The time before the bad data quality is set is a user configurable function (Good Data Wait).

4.2.2.2 Scanner Task

The scanner processes each smart device on every port and requests the configured data. The scanner runs at a user configurable base rate and requests data at the segment's configured scan rate, a multiple of the base rate. The request goes to the end of the transmitter output queue for output to the device. If the segment is a Scan Complete Acknowledge it is processed in one of two ways. If the segment's scan rate is zero then the command is sent after the READ command with the longest scan rate, or if it is a non-zero value then the command will go out at that given scan rate like a READ command. Note: if there are no read commands, which must have a scan rate, then the SCA must have a scan rate.

4.2.2.3 Output Request Task

The output request task takes a request from the CCF output request queue and creates a command request which is then sent to the transmitter via the transmitter queue. If grouping is turned on it combines as many outputs as allowed into one command and places the request on the transmitter queue. If any outputs are placed on the transmitter queue, the transmitter is signalled to process it.

4.2.2.4 Transmitter Task

The transmitter takes requests off the transmitter queue allowing no more than one command to be pending per smart device and sends the request to the appropriate port.

4.2.2.5 Receiver Task

The receiver takes the response from the smart device, determines whether there is a request pending and that it matches with the response, updates the data base and flags CCF if the response was to a digital read and any values have changed.

4.3 Runtime Displays

The runtime displays allow you to view parameter and status information for smart devices and the SHIM they are connected to, as well as provide the capability to tune various configurable parameters of a smart device.

Fields on the tuning displays contain either dynamic information (upper/lower range values, primary value units, descriptor information, date, transmitter configurable message, and damping value) or static information (digital value, command status, transmitter and CCF loop tags, and sensor limits). The entries you make in these fields when changing a smart device's parameters depends on the type of field. For example, a data field such as for the damping value requires a numeric entry while another field may provide a selection menu of available choices such as PSI, LBS and so on for transmitter units.

4.3.1 Display Hierarchy

Runtime tuning of smart devices is accomplished through a series of hierarchical displays. Specifically, the displays and the tuning information they provide are listed below:

Smart Device Network Overview
lists status of each SHIM connected to and configured for a particular Advant Controller serial port as well as the number of smart devices connected to each SHIM.

Smart Device I/O Display
lists data base information such as the device tag name, CCF tag name, descriptor, and digitally read value for up to eight smart devices connected to a particular SHIM.

Smart Device Tuning Overview
allows you to change the configuration parameters for a particular smart device and download the changes to the smart device's data base.

Figure 4-3 shows the hierarchy of these displays.

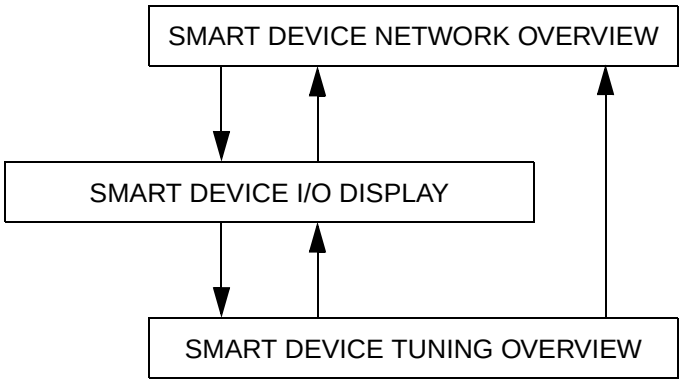


Figure 4-3. Hierarchy of Diagnostic Runtime Displays for Smart Devices

4.3.2 Accessing Runtime Transmitter Displays

The runtime transmitter tuning displays are accessed from Subsystem Status Displays which are accessed from the System Status Display. The System Status Display, Figure 4-4, is called up at any time from the operator control panel or by pressing the SYSTEM STATUS key on the keyboard. The status blocks show the current status of all subsystems (nodes) recognized on the DCN. If the status block for a particular subsystem is not shown on the System Status Display, use the SCROLL UP and SCROLL DOWN keys on the alphanumeric keyboard to call up additional pages of status blocks.

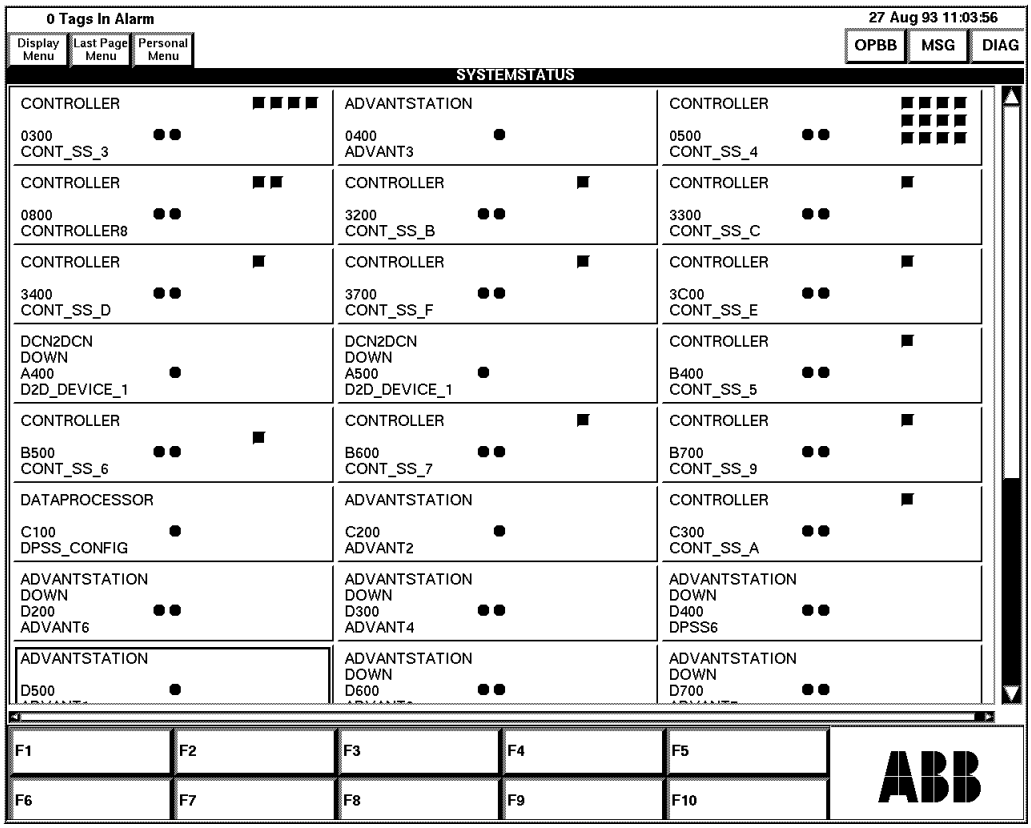


Figure 4-4. System Status Display

To access a Subsystem Status Display, simply select its subsystem status block. Figure 4-5 and Figure 4-6 are examples of the Subsystem Status Displays for an Advant Controller 410 and Advant Controller 460 subsystems, respectively.

Figure 4-5. Advant Controller 410 Status Display

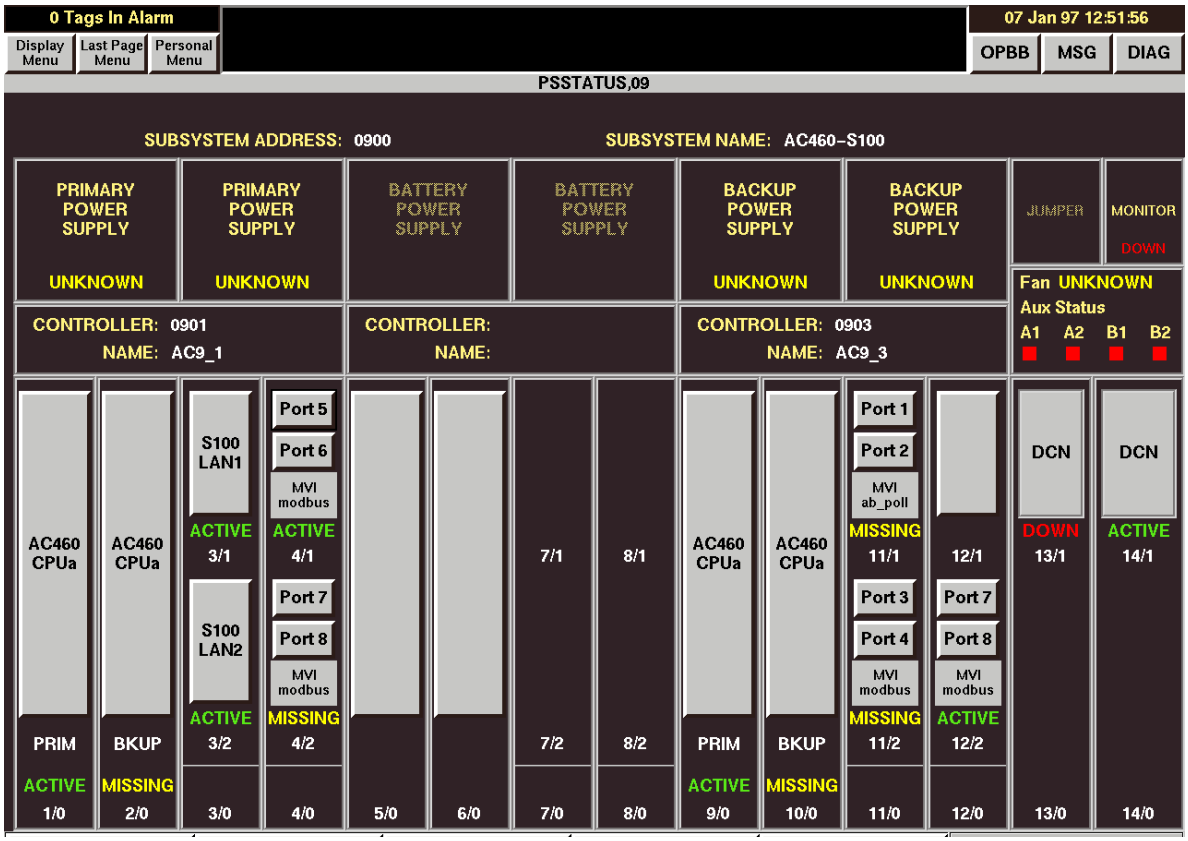


Figure 4-6. Advant Controller 460 Subsystem Status Display

To access the Smart Device Network Overview Display, simply select the MVI PORT X softkey that represents the port that is connected to the SHIM.

4.3.3 Smart Device Network Overview Display

The Smart Device Network Overview Display contains 32 status boxes, providing information related to all SHIMs configured for the Advant Controller serial port selected on the Advant Controller Subsystem Status Display. Information only appears in a status box if a SHIM is actually configured for the serial port.

Figure 4-7 shows an example of a Smart Device Network Overview Display an Advant Controller with an RS-485 connection to 31 SHIMs.

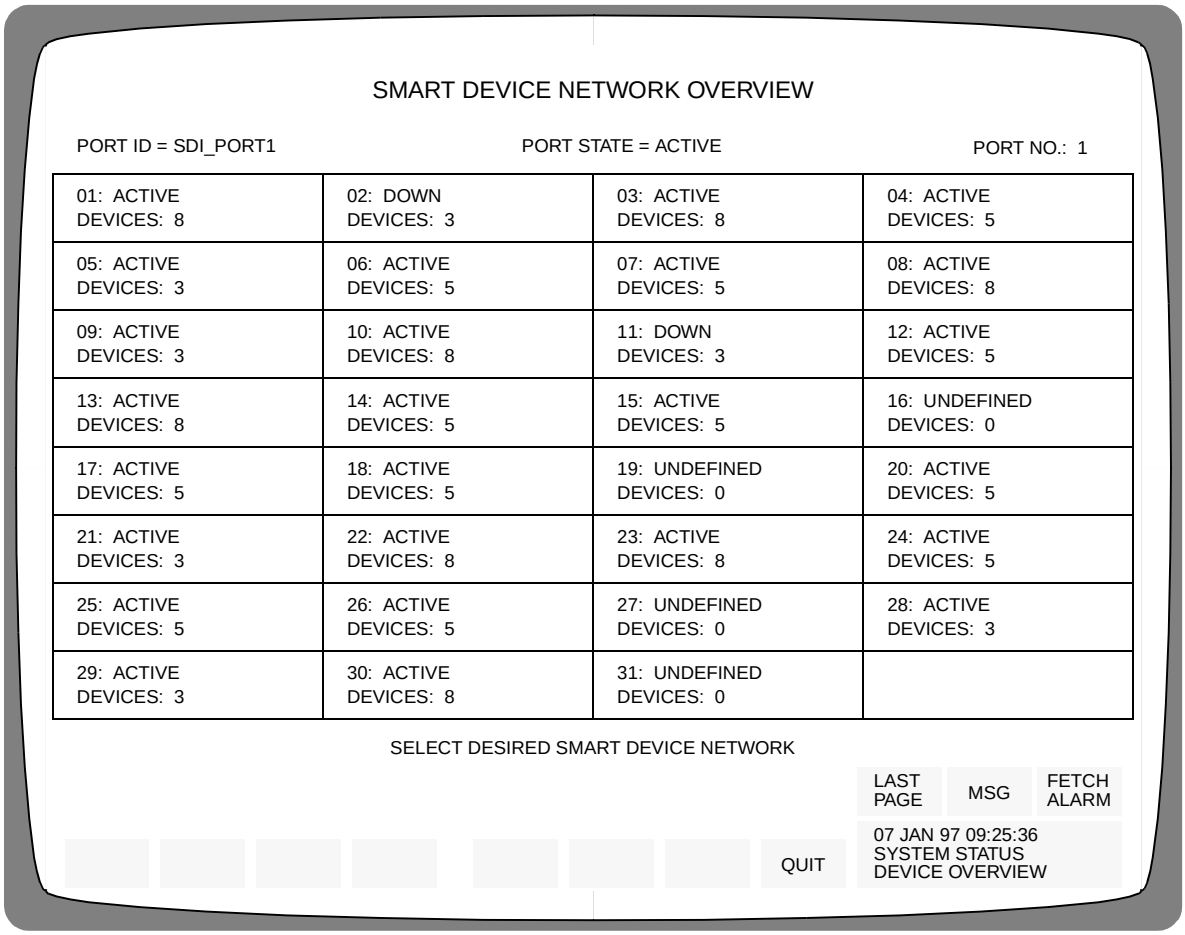


Figure 4-7. Smart Device Network Overview Display

Each box contains the SHIM's network address, status, and the number of smart devices connected to that SHIM. Possible states of a SHIM network are ACTIVE (green), DOWN (red), and UNDEFINED (yellow).

For an RS-232 connection directly to a SHIM, the status of only one network will be ACTIVE on this display. The status for all other networks on the display is UNDEFINED with 0 (zero) devices.

The softkeys on the Smart Device Network Overview Display and the functions they perform include:

Softkey	**Function**
QUIT	returns you to the Subsystem Status Display

From the Smart Device Network Overview Display, you can access the Smart Device I/O Display for a specific SHIM network by selecting the desired network's box in response to the prompt above the softkeys.

4.3.4 Smart Device I/O Display

The Smart Device I/O Display shown in Figure 4-8 provides information regarding the transmitter and CCF tag names and digitally read value (mA regardless of engineering units scale) for up to eight smart transmitters on the selected SHIM network.

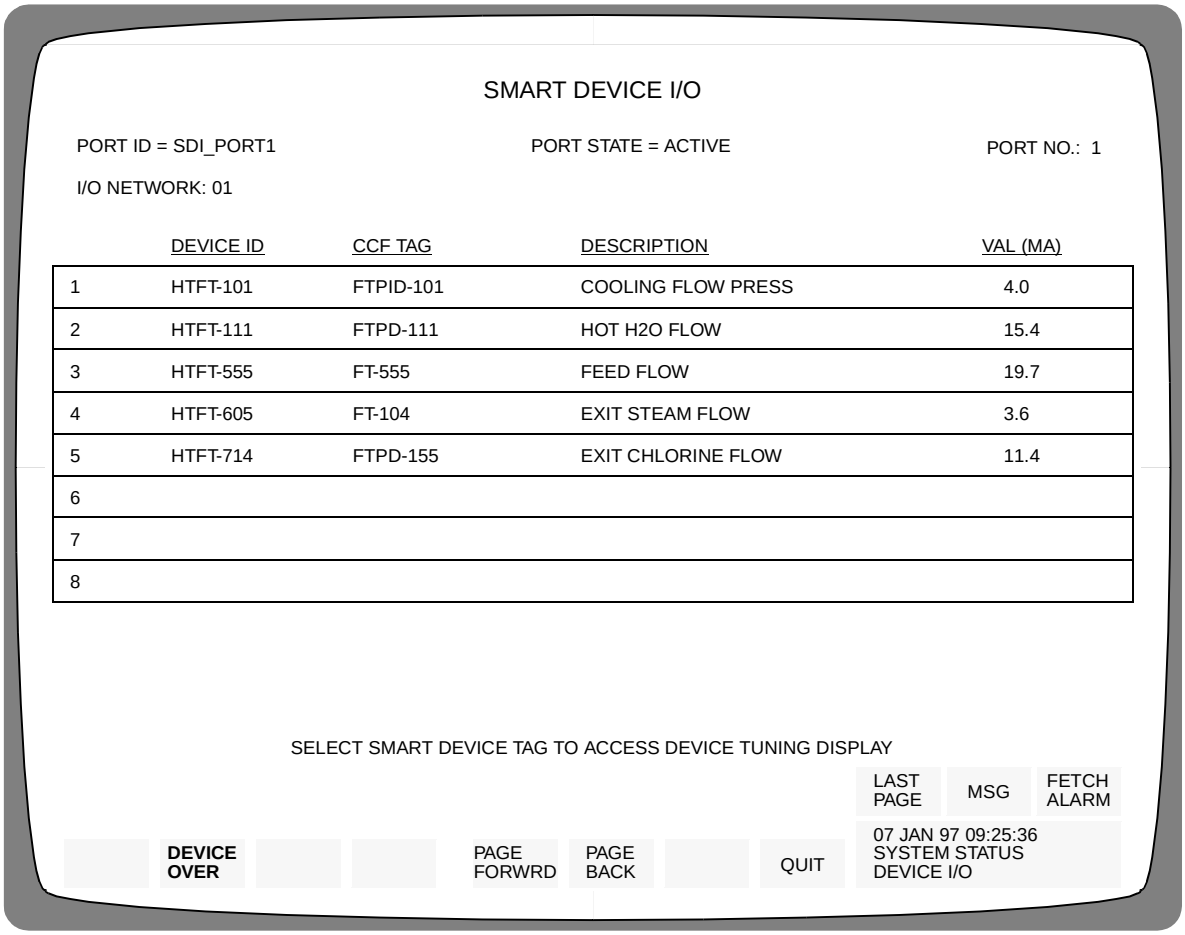


Figure 4-8. Smart Device I/O Display

A value turns red to indicate the smart device is inactive (down), and red Xs in the value column indicate the port is down.

The PAGE FORWRD softkey calls up the Smart Device I/O Display for the next higher numbered SHIM network, and the PAGE BACK softkey calls up the Smart Device I/O Display for the next lower numbered SHIM network.

From the Smart Device I/O Display, you can either return to the Smart Device Network Overview Display by selecting the DEVICE OVER softkey key or call up the Smart Device Tuning Overview Display for a specific smart transmitter by selecting the desired transmitter's tag name in response to the prompt above the softkeys.

4.3.5 Smart Device Tuning Overview Display

The Smart Device Tuning Overview Display shown in Figure 4-9 provides information read from the transmitter data base and the transmitter itself in a split screen format.

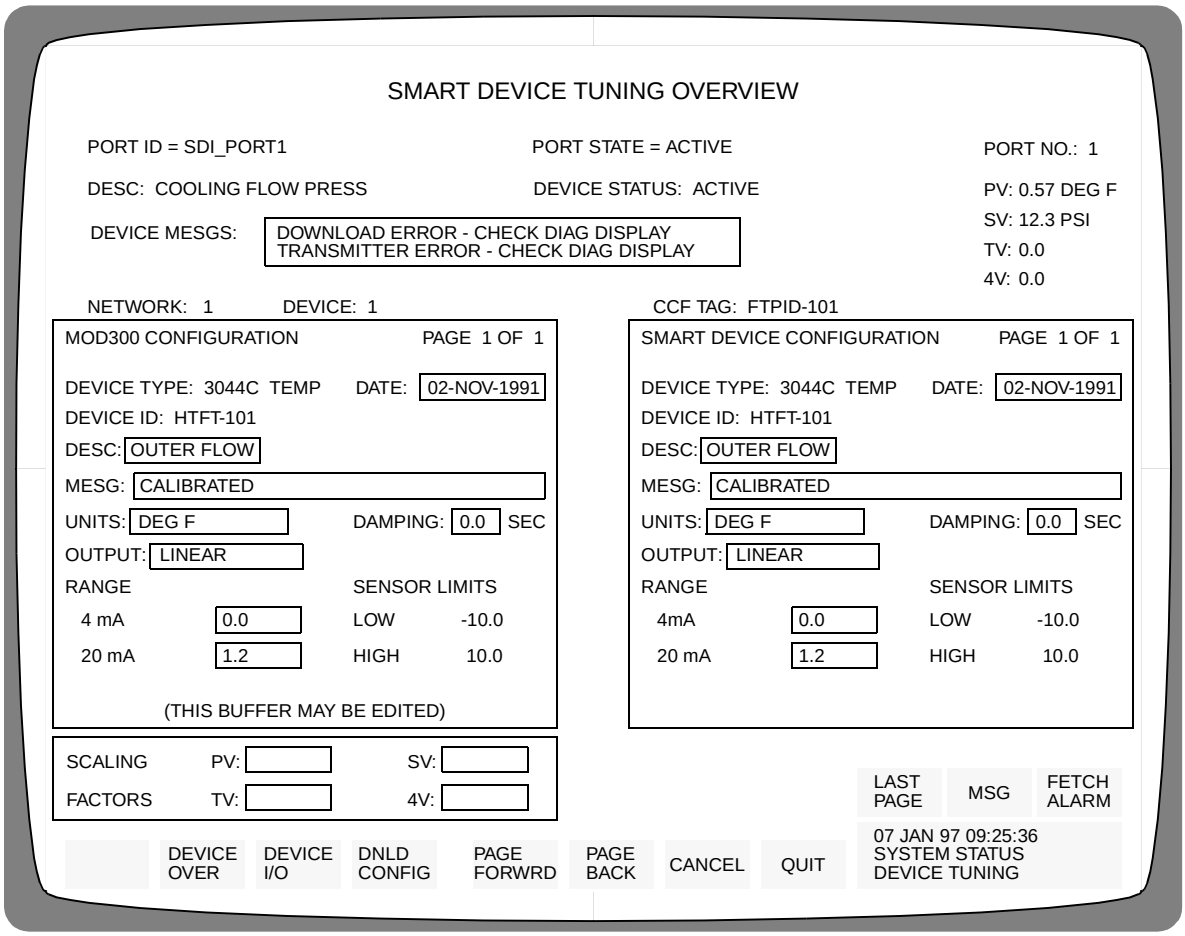


Figure 4-9. Smart Device Tuning Overview Display

Upon entering the display, the left and right portions of the screen contain the same information. The left portion of the display contains a local copy of the transmitter data base. The right portion of the display contains smart device configuration information pertaining to the transmitter data base read from the smart transmitter on a continual basis.

You can change the local information in the left portion of the screen and download these changes to the transmitter as described in Section 4.3.5.1, Tuning Smart Devices via the Smart Device Tuning Overview Display.

In the lower left portion of the display is a box containing the SCALING FACTORS used by the four process variables. These values may be changed and downloaded just as the other data, but since this data is not stored in the database, the current values cannot be displayed on the right side. Changes to these values will be reflected in the precision of the process variables.

Above the controller and smart device configuration information, there is a two line message area. This area contains messages generated as a result of a field device status error or a downloading error. If either a status or downloading error is detected, the actual error message is sent to the Diagnostic Package and the corresponding message below appears in the message area of the Smart Device Tuning Overview Display:

TRANSMITTER ERROR - CHECK DIAG DISPLAY

DOWNLOAD ERROR - CHECK DIAG DISPLAY

Examples of status and downloading errors are provided in Chapter 5, Maintenance.

The softkeys on the Smart Device Tuning Overview Display and the functions they perform include:

Softkey	**Function**
DEVICE OVER	returns you to the Smart Device Network Overview Display
DEVICE I/O	returns you to the Smart Device I/O Display
DNLD CONFIG	downloads the changes you made to the local copy of the transmitter data base to the smart device for execution
PAGE FORWRD	calls up the Smart Device Tuning Overview Display for the device with the next higher transmitter address on the SHIM
PAGE BACK	calls up the Smart Device Tuning Overview Display for the device with the next lower transmitter address on the SHIM
CANCEL	when selected prior to confirming the download process, cancels the downloading of parameters to the transmitter data base
QUIT	returns you to the Subsystem Status Display

4.3.5.1 Tuning Smart Devices via the Smart Device Tuning Overview Display

The smart device parameters you may change on the Smart Device Tuning Overview Display include the date, the device's descriptor, message text, units, damping value, output type, and range limits (4 to 20 mA). You can change these parameters and download them to the smart device's transmitter data base as described in the steps below.

1. Select the field in the left portion of the display for the parameter you want to change.
2. Enter the text or value valid for the type of device and appropriate for the parameter you want to change.

   For the DATE, DESC, and MESG fields, enter the desired text string.

   For the UNITS and OUTPUT fields, several options are available. You can view the options by pressing the NEXT CHOICE key until the desired choice appears and press the ENTER key, or type the text string for the desired entry and press the ENTER key.

   For the DAMPING and RANGE fields, enter the desired decimal value.
3. Repeat steps 1 and 2 until all parameters for the smart device are changed as desired.

4. Select the DNLD CONFIG softkey.

   You are then prompted to select the DNLD CONFIG softkey again to confirm that you really want to download the changes to the smart device's transmitter data base.

5. Select the DNLD CONFIG softkey to start the downloading process.
   or
   Select the CANCEL softkey to cancel downloading them to the smart device's transmitter data base.

6. If the download is confirmed, the field name for each field whose entry in the left portion of the screen is different from the entry in the right portion of the screen changes to red. When the smart device receives the change, the field name returns to cyan.

Once the downloading process is complete, the smart device configuration information in the right portion of the display is updated to the actual contents of the transmitter data base. If the downloading process is successful, messages indicating the parameters changed are sent to the Event Logging Package.

4.3.5.2 Runtime Parameter Change Logging

Changes made to the smart transmitter data base via the Smart Device Tuning Overview Display are logged by the Event Logging Package, providing a method of determining any past activity to the transmitter data base contents via the Tuning Display and data base integrity via time-stamped messages. The information provided in logged messages includes the parameter changed, the old value, the new value and transmitter tag name of the smart device whose parameter was changed.

NOTE

Changes made to the transmitter data base via an external source (hand-held monitor) ***are not*** logged.

Chapter 5 Maintenance

5.1 Introduction

This chapter explains configuration-related error codes that can be returned by the Advant Smart Device (HART) Interface to the Advant OCS and reported as diagnostic messages on the Diagnostic Message Display. For further information on Advant OCS diagnostics, refer to the *Subsystem Status and Diagnostics* instruction book.

5.2 Hardware Indicators

5.2.1 CI532V02 MVI Submodule LEDs

The CI532V02 MVI (ModbusB) Submodule (Figure 5-1) has two status LEDs. The Fault (F) LED will illuminate red to indicate a board fault and it is also on when the module is reset. The Run (R) LED will illuminate green to indicate the module is running normally and port characteristics have been properly set by the host CPU.

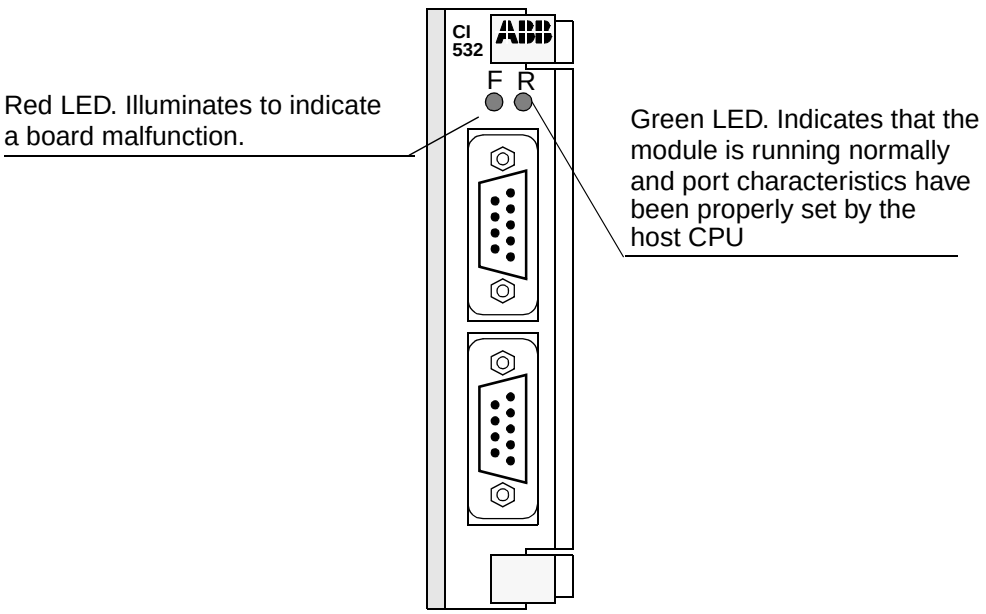

CI
532
F R
Red LED. Illuminates to indicate a board malfunction.
Green LED. Indicates that the module is running normally and port characteristics have been properly set by the host CPU

Figure 5-1. MVI Module Status LEDs

5.2.2 SHIM Indicators

As shown in Figure 2-15, the SHIM has 3 red diagnostic LEDs. The one on the front panel flashes to indicate the SHIM passed its self test and is operational. The other LEDs are visible through the ventilation slots in the top of the housing. The LED closest to the back of the

housing is illuminated if a RAM error is detected, and the other LED is illuminated if a ROM checksum error is detected. If the LED on the front panel is not flashing and either of the other LEDs is illuminated, the SHIM is not operational and should be replaced.

5.3 Error Messages

This section explains error codes returned by the Smart Device Interface to the Advant OCS System and reported as diagnostic messages on the Diagnostic Message Display.

5.3.1 Diagnostic Messages

As a benefit of the Smart Device Interface, you can continuously receive diagnostic information from smart devices in the field via digital communications when reading the primary value. This information is not provided with standard analog processing.

Diagnostic information retrieved from the smart device is incorporated into the Advant OCS Diagnostic Package with details indicating which device generated the error and its logical location in the field (that is, the Advant Controller (MVI) serial port and SHIM network address).

The following examples show the format of the diagnostic messages generated for SHIMs:

SMART NETWORK 2 FAILED TO RESPOND ON PORT 5

SMART NETWORK 2 HAS RESUMED COMMUNICATION

The first message is generated when the wiring between the serial I/O port and SHIM is disconnected, severing communication with the SHIM and all smart devices connected to that SHIM. The second message is generated when the physical connection between the serial I/O port and SHIM is re-established, resuming communication with the SHIM and all smart devices connected to that SHIM.

Both of these messages have 2 digits reserved for identifying the network address (1-31) of the SHIM that failed or resumed communication. The first message also has 2 digits reserved for identifying the serial I/O port to which the SHIM is connected. This allows you to easily locate the SHIM in field and correct the problem.

The following is an example of a communication error code returned by a SHIM:

SDI: ERROR 1 RECEIVING MSG FROM NETWORK 5

The first number in the error message indicates a communication error, and the second number identifies the SHIM's network address where the communication error occurred.

The following examples show the format of the diagnostic messages generated for smart devices:

SMART DEV 201 FAILED TO RESPOND ON PORT 5

SMART DEV 201 HAS RESUMED COMMUNICATION

SMART DEV 201 SENT ERROR CODE 2

The first message is generated when the wiring between the smart device and SHIM is disconnected, severing communication with the smart device. The second message is generated when the physical connection between the smart device and SHIM is re-established, resuming

communication with the smart device. The third message is generated when an error is detected for a specific smart device when data is being downloaded to the transmitter from the Smart Device Tuning Overview Display. To view the message, use the ALL TEXT option of the Diagnostic Package.

All three messages above have 4 digits reserved for identifying the smart device that failed, resumed communication, or generated an error. The first 2 digits identify the network address (1-31) of the SHIM to which the smart device is connected. The last 2 digits identify the transmitter address (1-8) where the smart device is connected to the SHIM. Note that the smart device's transmitter address is preceded by a 0 (zero), and SHIM network addresses 1 through 9 are preceded by a blank space. The first and third message above also contain a second number.

In the first message the second number has 2 digits reserved for identifying the serial I/O port to which the SHIM is connected. This allows you to easily locate the smart device in the field and correct the problem. The second number in the third message is 3 digit value you must decipher to determine the problem with the smart device. The value indicates a device-specific error code, resulting from a download error generated when data is being downloaded to the transmitter from the Smart Device Tuning Overview Display. Consult the documentation provided by the smart device's manufacturer for details on the code's meaning.

All of the following messages indicate field device status problems:

SMART DEV 201 NON-PV OUT OF SENSOR LIMITS

SMART DEV 201 NON-PV BACK IN VALID RANGE

SMART DEV 201 PV OUT OF SENSOR LIMITS

SMART DEV 201 PV BACK IN VALID RANGE

SMART DEV 201 PV ANALOG OUTPUT FIXED MODE

SMART DEV 201 PV ANALOG OUTPUT NORMAL MODE

SMART DEV 201 PV ANALOG OUTPUT SATURATED

SMART DEV 201 PV ANALOG OUTPUT NON-SATURATED

The numbers in the above messages identify the smart device in the field in the same manner as described above.

Process alarms, bad data quality, and so on is handled directly by CCF based on the input from the input tables accessed by CCF.

Runtime tuning changes to the smart transmitter data base made by the operator at the Advant OCS console are logged by the Event Logging Package. *Tuning changes made with a hand-held monitor are not logged*.

5.4 Fault Finding and User Repair

Please refer to the *Advant Controller 410 User's Guide* and the *Advant Controller 460 User's Guide* for details on trouble shooting and repair.

5.4.1 User Repair

5.4.1.1 Board and Subrack Mounted Unit Replacement

General

In the following text the word board includes circuit boards and rack mounted units as well. Example of such a unit is the Voltage Regulator.

It is important to understand the consequences of a board exchange on-line and how it affects the current situation. For example:

- Replacement of a communication board type affects all channels on all the boards in a subrack.

The system software in the Advant Controllers checks automatically that all I/O boards function correctly. In the event of board fault, and board exchange, the board and associated signals are marked as faulty. While the fault marking is present, the value is not updated in the data base.

The system software checks that the board is inserted and correct. If this is the case, the Fault-indicator (LED) extinguishes (after 10 seconds), the fault marking in the data base is reset and the board resumes its normal function.

The following headings include general instructions for replacement of circuit boards and aspects on the handling of individual circuit boards are presented in Table 5-1.

Practical Execution

Replace faulty or suspect circuit boards and units in the following way:

1. Pay attention to safety regulations and observe all precautions before starting work.
2. Special restrictions apply to the board type. See description in Table 5-1 for other useful information on individual board types.
3. Whenever possible, switch off the power supply to the subrack.
4. Provide access to the board/unit by loosening the board locking:
   - Loosen the screws in the pull handles of boards in the controller subrack.
   - The bar in front of the boards in the I/O subrack.
5. Grip the board firmly and extract the board quickly and decisively.
6. Check that the new board can replace the old:
   - Make sure that the jumpering is the same as that of the old board.
7. Insert the new board carefully without reaching the rear plane contacts. Ensure that the board slides in the guides in the subrack.
8. Push in the new board quickly and decisively.
9. Store extracted boards in envelopes of conductive plastic.

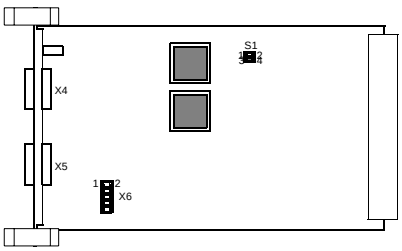
10. Ensure that the board contacts mate properly with the contacts in the rear plane and screw the locking mechanism in place.
11. Boards which can be replaced during operations are initialized automatically by the system and the fault indicating LED extinguishes automatically after approximately 10 seconds.
12. Perform a function test on the new board.

Additional Aspects on Individual Board Types

Table 5-1 lists AC460 subrack boards (applied in the controller subrack). Descriptions of these types are referred individually in the table.

The S100 I/O boards are described in the *S100 I/O User's Guide.*

Table 5-1. Replacement Aspects on Boards in the Controller Subrack

Board Type - Jumpering		Comments
CI532V02 **MVI** **Submodule**	No operational jumpering on module S1 used for testing (no jumpers). X6 is a debug communications port used for testing. 	- Replacement with power applied is possible. - Described in: *Advant Controller 410 and 460 User's Guides* -May affect serial I/O communication with device.
SC510 **COMM 1**	No jumpering	- Replacement with power applied is possible.

5.4.1.2 Smart Device Removal and Installation Procedures

Smart Device Removal

To remove a smart device for servicing or replacement, disconnect all field wiring from the smart device at the screw terminations on the analog termination panel if connected to one, the SHIM, and the smart device itself.

NOTE

The physical connection between a smart device and a SHIM is made using a cable referred to as a HART Bus. The HART Bus cable is a 18 to 20 AWG, shielded twisted pair.

The maximum length of the HART Bus is 10,000 ft. (3,048 m) or is determined using the following formula, whichever is less:

$L = 65{,}000{,}000 / (R \times C) - (C_f + 10{,}000) / C$

where L is the length in feet or meters, R is the total loop resistance in ohms, C is the cable capacitance in pF/ft. or pF/m, and C_f is the sum of CN values of smart devices multiplied by 5,000 pF. For smart devices without CN values, use 1. Masters (primary and secondary) need not be counted in deriving C_f.

Smart Device Installation

To install a smart device:

1. Dress the wires at both ends of the HART Bus cable for easy connection to the smart device and SHIM screw terminations.
2. Screw the wires at one end of the HART Bus cable to the screw terminations for the positive and negative contacts of the smart device.
3. For the communication of both analog and digital signals from a smart device, the connections you make with the wires at the other end of the HART Bus depend on the type of I/O used to bring the signals into the Advant Controller.

Appendix A PLC Directory References

A.1 PLC Reference Objects

These objects are directly under the MOD_DB (data base) object, and is supplied along with the model data base. They define the allowable commands for each type of programmable controllers. They should not be modified by the user.

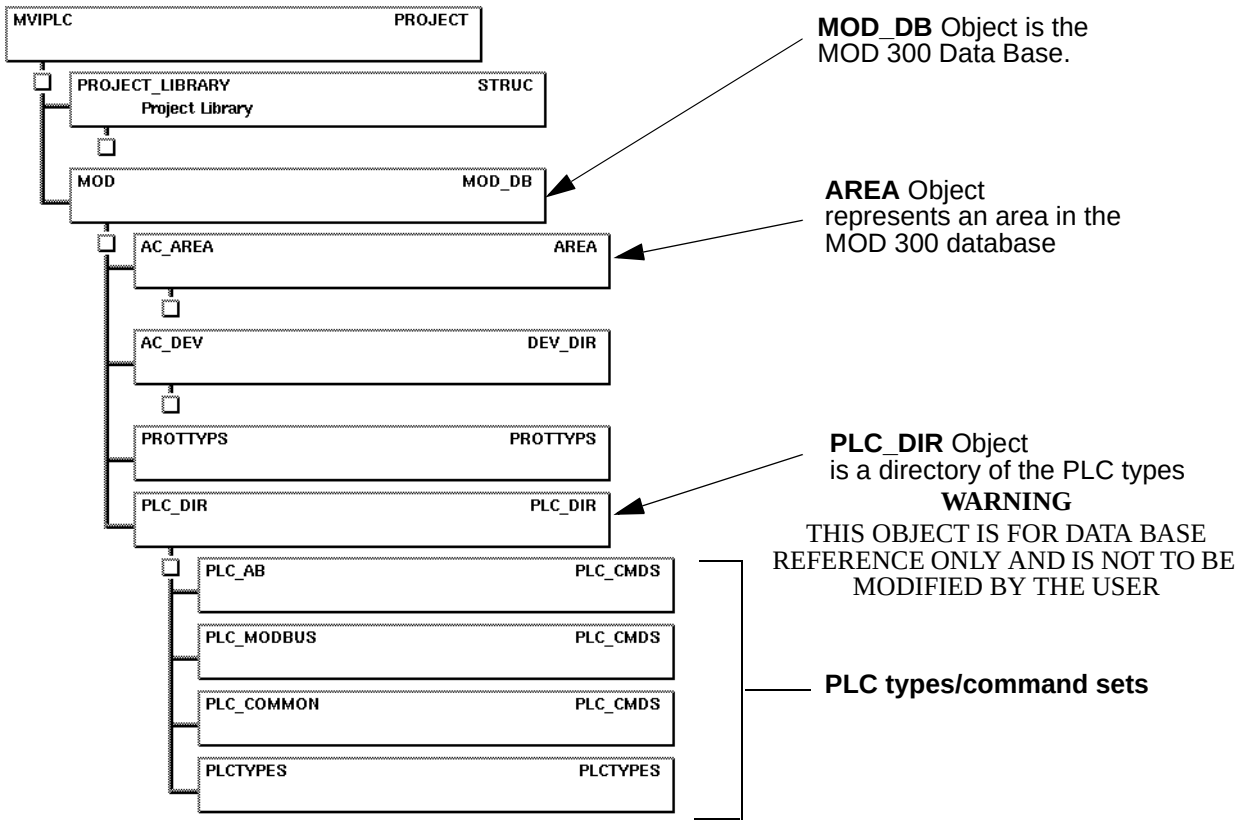

MVIPLC PROJECT
PROJECT_LIBRARY STRUC
Project Library
MOD MOD_DB
AC_AREA AREA
AC_DEV DEV_DIR
PROTTYPS PROTTYPS
PLC_DIR PLC_DIR
PLC_AB PLC_CMDS
PLC_MODBUS PLC_CMDS
PLC_COMMON PLC_CMDS
PLCTYPES PLCTYPES
MOD_DB Object is the MOD 300 Data Base.
AREA Object represents an area in the MOD 300 database
PLC_DIR Object is a directory of the PLC types
WARNING
THIS OBJECT IS FOR DATA BASE REFERENCE ONLY AND IS NOT TO BE MODIFIED BY THE USER
PLC types/command sets

Figure A-1. MOD Data Base Hierarchy

A.1.1 PLC_AB Initial Data Base

This PLC_CMDS object from which all other databases are initially copied and created contains commands which are used to communicate with Allen-Bradley programmable controller devices using Allen-Bradley Data Highway protocol. The TEMPLET NAME of this object is used as the COMMAND SET field entry in the PLC_DEF object (see Section 3.3.5.3, PLC_DEF Object).

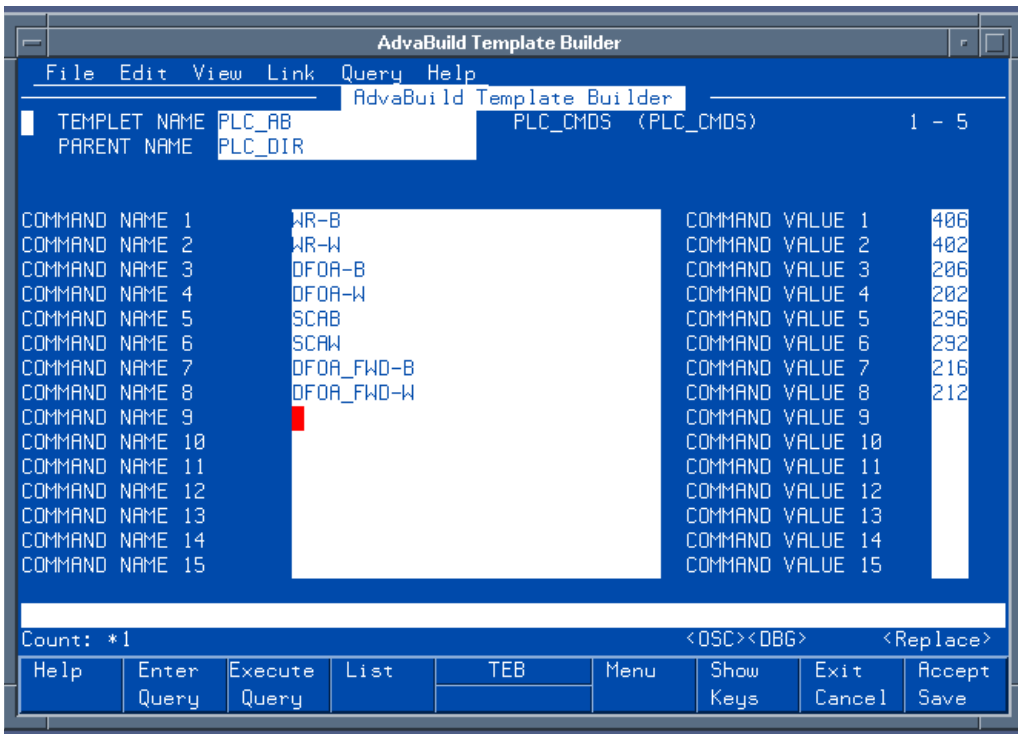


Figure A-2. PLC_AB Reference Object

Each command (name) corresponds to a code (value) that us used by the MVI module to produce the correct protocol to the PC device for the function desired.

WARNING

THIS OBJECT IS FOR DATA BASE REFERENCE ONLY AND IS NOT TO BE MODIFIED BY THE USER.

A.1.2 PLC_MODBUS Initial Data Base

This PLC_CMDS object from which all other databases are initially copied and created contains commands which are used to communicate with Modicon programmable controller devices using MODBUSB (binary) protocol. The TEMPLET NAME of this object is used as the COMMAND SET field entry in the PLC_DEF object (see Section 3.3.5.3, PLC_DEF Object).

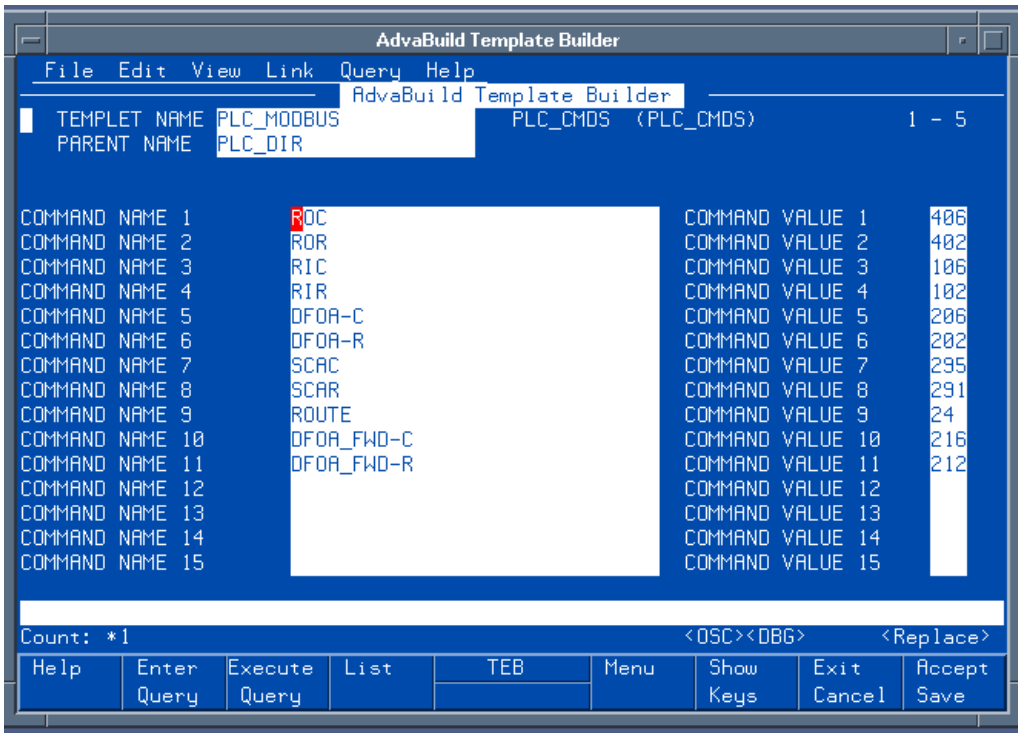


Figure A-3. PLC_MODBUS Reference Object

Each command (name) corresponds to a code (value) that us used by the MVI module to produce the correct protocol to the PC device for the function desired.

NOTE

A non-configurable command (Code 08) is sent by the MODBUS MVI board which is a Loopback Diagnostic Check command. Devices connected to the MVI must be able to respond to this command.

WARNING

THIS OBJECT IS FOR DATA BASE REFERENCE ONLY AND IS NOT TO BE MODIFIED BY THE USER.

A.1.3 PLC_COMMON Initial Data Base

This PLC_COMMANDS object from which all other databases are initially copied and created contains commands which are used to communicate with generic programmable controller devices. The TEMPLET NAME of this object is used as the COMMAND SET field entry in the PLC_DEF object (see Section 3.3.5.3, PLC_DEF Object).

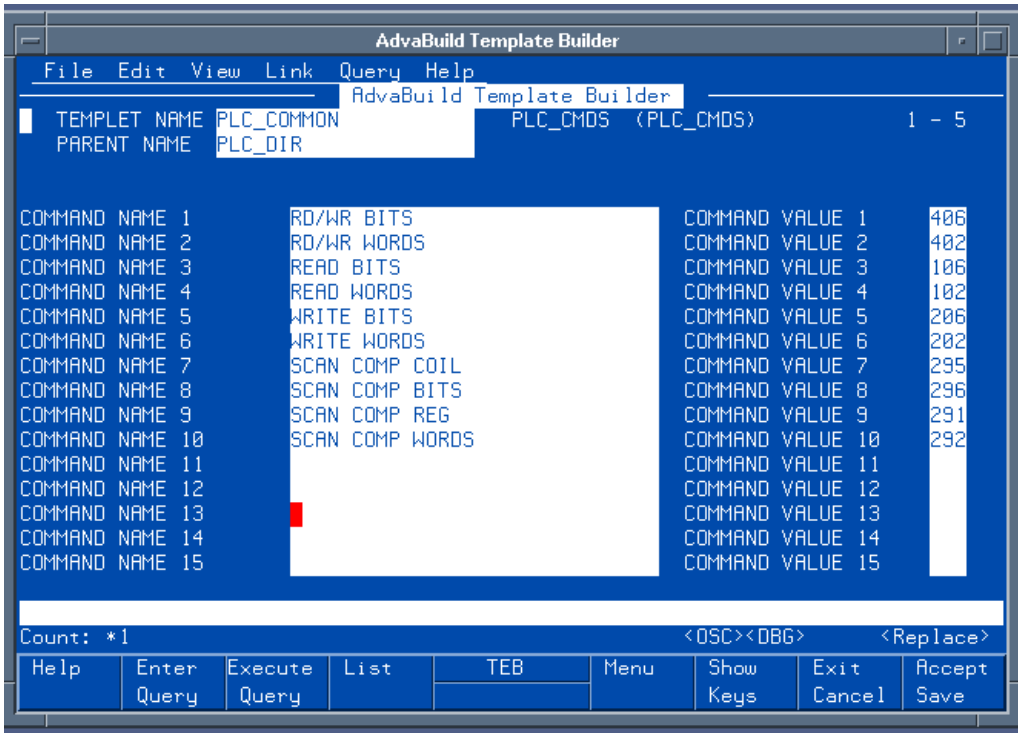


Figure A-4. PLC_COMMON Reference Object

Each command (name) corresponds to a code (value) that us used by the MVI module to produce the correct protocol to the PC device for the function desired.

WARNING

THIS OBJECT IS FOR DATA BASE REFERENCE ONLY AND IS NOT TO BE MODIFIED BY THE USER.

A.1.4 PLCTYPES Initial Data Base

This PLCTYPES object from which all other databases are initially copied and created contains the different types of PC devices that are supported by the system. The names are used by the PLC_DEF object as the PLC DEVICE TYPE field entry (Section 3.3.5.3, PLC_DEF Object).

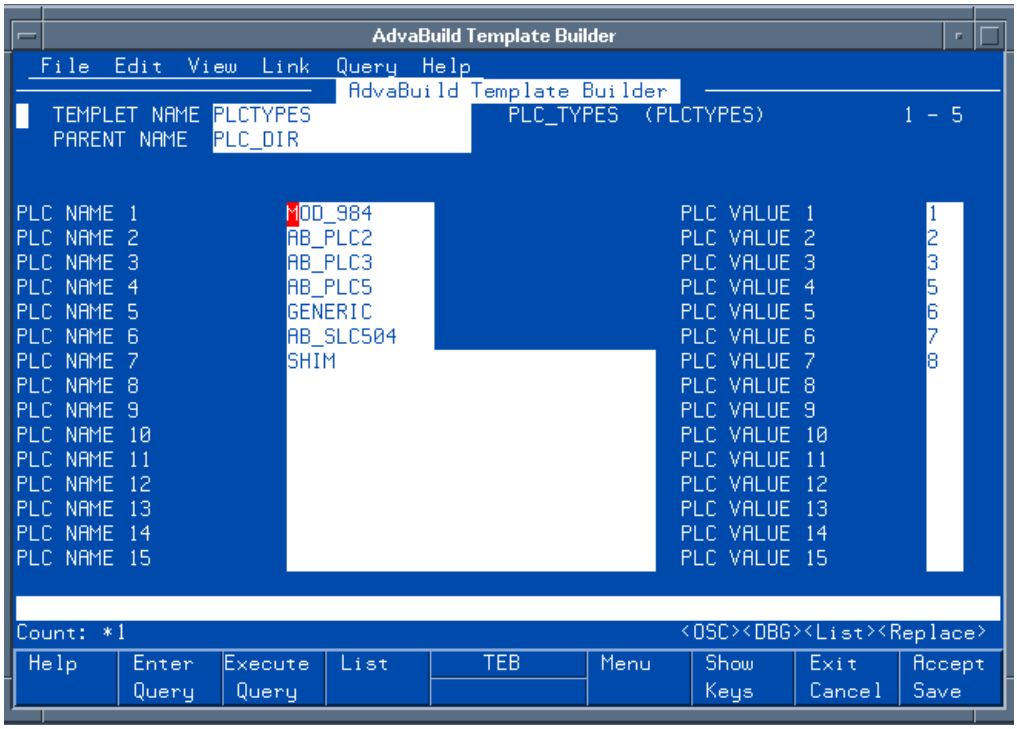


Figure A-5. PLCTYPES Reference Object

Each command (name) corresponds to a code (value) that us used by the MVI module to produce the correct protocol to the PC device for the function desired.

WARNING

THIS OBJECT IS FOR DATA BASE REFERENCE ONLY AND IS NOT TO BE MODIFIED BY THE USER.

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